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PAY-TV: SCRAMBLING AND HOW IT WORKS

Electronics AUSTRALIA WITH ETI

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AUSTRALIAN PUBLICATION

REVIEW OF NEW PHILIPS WIDESCREEN COLOUR TV

PROJECTS: LOW COST TEMPERATURE CONTROLLER, WIDEBAND NOISE SOURCE FOR 'SWEEPING' WITH OUR ECONOMY SPECTRUM ANALYSER

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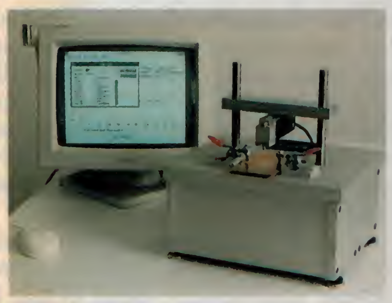
Electronics AUSTRALIA WITH ETI

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Slim automatic camcorder

Panasonic's new A1 'Slim Palmcorder' offers many automatic features, and is intended for those who want an easy-to-drive model. You'll find more about it on page 7...

Computer-based tester



Canadian firm Qualitest has developed a small PC-based testing system which can be adapted for many different testing applications, using software running under Windows. More details in Computer News, page 126.

On the cover

Pictured at the recent official launch of Philips' new widescreen colour TV receivers was well-known movie guru Bill Collins, who took part in a presentation by comedy duo 'Roy Slavin and H.G. Nelson'. This issue includes a 'hands on' review of the new 76cm set by Jim Rowe, starting on page 8.

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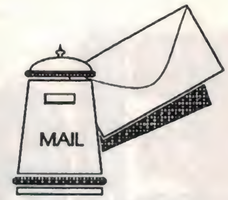
LETTERS TO THE EDITOR



Betetec speaker review

This letter concerns the review done by Mr Challis (February 1994), on one of our products, the Aaron 'Eclipse'. While the review was very positive towards this model we wish to have the opportunity to correct a few mistakes. It won't change the complexion of the review, but the facts need to be kept straight, especially when we are discussing a new technical approach to low frequency bass alignment.

The statement that 'the International Electrotechnical Commission are adamant that this loudspeaker should be classified as a 4-ohm speaker' is incorrect. In fact the IEC 268-5 standard states that the impedance can go 20% lower than the nominal impedance. So therefore our quoting a nominal impedance of six ohms is more correct in this case.

Another incorrect statement is 'The Eclipse was claimed to use a Low Q Ratio alignment — which most of his competitors also use'. This statement concerns us even more than the first, as *no one* else in the world uses our type of driver or bass alignment. I think Mr Challis has confused our new concept with a normal low Q speaker, which bears no resemblance to our woofers. In our case the Low Q Ratio refers to the ratio of mechanical losses to the electrical losses. We have reduced the mechanical losses so they are closer in magnitude to the electrical losses. This was achieved by three main methods. One was a drastic reduction of the driver's moving mass; the second was by increasing the compliance of the suspension system (i.e., the mechanical/acoustic compliance); and lastly the reduction of cabinet losses.

The third incorrect statement was 'Hume L'Estrange, who has assured me that the future production models will incorporate the Pink Poly or similar absorptive media'. This is just not true and nor can it ever be. If we were to do something like this it would negate our Low Q Ratio alignment by introducing huge cabinet losses with restriction of air movement. We solve the problem of potential standing waves with the use of our standing wave diffuser.

As to Mr Challis's pre-occupation with cabinet standing waves, may I suggest he takes a look at his own graphs. Firstly these standing waves have been shifted to a position near the crossover frequency thus reducing the magnitude by 3dB. Secondly the width of the standing wave dip is less than one third of an octave, thus becoming inaudible to the human ear, at those frequencies. For verification of the fact one can read works from any one of the following psychoacoustic researchers: H. Staffeldt, Floyd E. Toole, Albert S. Bregman, Herman Helmholtz, Fletcher and Tobias (authors of the critical band chart). We used the standing wave diffuser to break a large single standing wave that would otherwise occur into several narrower smaller standing waves, to render them inaudible.

We realise that these mistakes were in no way intentional and understand that Mr Challis is a very busy man. Being so, he would not always have as much time as he would wish, to devote to matters before him on his desk.

Hume L'Estrange,
Betetec Industries,
Ballina, NSW.

SMA enquiry

My thoughts and opinions I believe have been displayed in previous News articles and letters concerning Spectrum Management Agency's reforms. It is with great hope that this letter will be read appropriately and bring attention to the issues which I feel are of great importance especially for the smaller communication companies and users of the spectrum.

As a general comment, the SMA 'Inquiry into the Apparatus Licence System' discussion paper is very vague in that it suggests lots of alternatives to the present system, but gives no supportive facts and figures. This is especially worrying when talking of the cost of a licence under any proposed systems.

The question of the number of different licence categories has no direct effect on my company or any of my customers, although I could see the advantage of reducing the number of licence categories. As far as the agency is concerned, operationally, it would be a major disadvantage to remove all licence categories.

A licence fee approach taking into account a cost component and a tax component would be a logical commercial approach. Other than an increased cost of a licence, I have no violent objections to

this approach, providing costs are on a recovery basis only.

The paper mentions the intention of the agency to accredit external frequency assigners. As an operator and service provider this is a worrying proposal. Frequency assignment is a complex and exacting task which takes many years of experience before becoming proficient. If external assigners are to be used, where are these people going to gain experience? Who will fix bad assignments?

The question of spectrum scarcity is another matter. It is mentioned that the SMA will be auctioning Spectrum Licences. I would be interested in knowing how the agency is going to go about this and still maintain the principle of 'providing a responsive and flexible approach to meet the needs of the users of spectrum'. If the auctioning process is put into place it would be disastrous for the smaller users and communication companies within the industry here in Australia. The auctioning process will give the large multinational companies the opportunity to over-inflate the price of the spectrum by bidding at high prices, putting the price out of reach for the small users therefore destroying the smaller opposition communication companies.

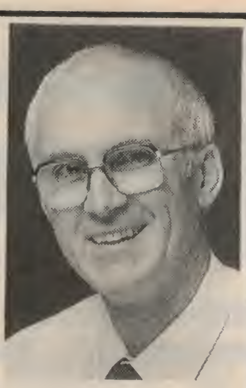
Extension of class licences to some of the existing apparatus licences is not a problem providing they still have to pay a fee. If all these class licences with no fees keep expanding, you don't have to be a great economist to work out this will cause a loss of revenue for the agency which must be countered by increasing fees in other areas.

In conclusion the Spectrum Management Agency is currently operating an efficient system, which is responsive to the needs of the industry. These proposed changes appear to be change for the sake of change and have the makings of being pushed by economists. I can see no reasoning for changes, other than economic for the SMA, and if they go ahead as proposed, will be disastrous for the small communications companies and small users of the spectrum in Australia. When decisions are made on purely economic grounds, they do not and will not stand the test of time in the real world.

Paris Cockinos, AMIET, SAIREE,
Paris Radio Electronics,
Kingsford, NSW.

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT



One of the paradoxes in fast-evolving technology...

One of the really good aspects of modern solid state electronic equipment, for the consumer, is that it's so much more *reliable* than its predecessors. As a result it tends to last longer, and require less servicing (which is bad news for the service industry, of course). This is despite the fact that in most cases, it's also much more *complex*, in terms of function.

On the other hand, the fast pace of developments in the technology also tends to mean that the same equipment tends to become *obsolete* much sooner than its predecessors did. Which means that we're all having to become a lot more careful, when we buy a new product, to ensure that it will be capable of serving our needs for at least a reasonable time — before having to be replaced with a newer model.

Personal computers provide an excellent example of this paradox. Buy one today, and the odds are that it will have a useful life of at most two or three years, before needing to be replaced...

Another area where a very similar situation applies is home audio/video entertainment technology — TV receivers, VCRs, CD and laserdisc players, and so on. With so many developments either taking place, or expected soon in this area, I'm sure most readers of *EA* would be quite cautious about investing right now in any of these products. For example, you'd want to be assured that a TV receiver bought now will be able to display the various kinds of Pay-TV signals that are becoming available, as well as signals from video CD players, digital VCRs and the other products that are likely to become available in the next few years...

In other words, the pace of technical development has forced most of us to think seriously about buying products that are not just well built and capable of delivering the right level of current performance, but also with as much built-in 'future proofing' as it's possible to provide. A consumer's decisions aren't getting any easier, are they?

What prompted me to reflect on these matters was the opportunity I had this month to try out one of the new Philips 76cm widescreen stereo TV receivers. You'll find my review in this issue, starting on page 8.

I found the performance of this set to be quite outstanding, which is perhaps not surprising since it incorporates just about every conceivable modern refinement — including the 'Panorama' system of displaying standard 4:3 PAL signals on the full 16:9 aspect ratio screen. But what was even more impressive, to me at least, were the signs that its designers had striven to make the set as compatible as possible with coming technologies. About the only feature *not* fitted was a direct digital video input — and I understand even *that* is likely to be available soon, as a retrofit option...

It's good to see manufacturers working towards this goal, isn't it?

Jim Rowe

What's New in VIDEO and AUDIO

Enhanced midi systems from Akai

Akai has announced two additions to its RX-series of midi audio systems. State of the art features such as MD compatibility, Akai's new triple CD changer and auto tape tuning technology combine to set these latest models ahead of their competitors.

The new RX-890 is the flagship model and offers DSP or digital signal processing features which recreate a number of live venues including Jazz Hall, Arena, Cathedral, Church, etc. Combine these with a three band parametric equaliser to match room characteristics and five pre-set/programmed memories for instant recall of room settings, and the RX-890 is claimed to offer unprecedented features versus price point. The RX-890 boasts 60 watts per channel and provides six inputs for phono, cassette deck, tuner, CD and VCR.

The RX-590 boasts 35 watts minimum, motor driven volume control, and surround sound via Akai's three way matrix type speakers. A total of six inputs are provided for MD, VCR, phone, CD, cassette deck and tuner.

Both models incorporate Akai's world first triple CD changers, which can provide up to three hours of uninterrupted music. The CD changer can select up to 30 selections from any of the three discs, in any order.

Both systems are covered by Akai's 12 month parts and labour warranty. The RX-890 ($1599) and RX-590 ($999) are available at selected dealers. For further information contact Akai on (02) 763 6300.

Planar speakers available again

ESA Audio are re-introducing to Australia the well known Bertagni or B.E.S.T. range of planar loudspeakers. The speakers will be marketed under the Sound Advance System brand, to coincide with the change of company name earlier this year. The change of name was part of the business plan formalised after

Car cassette receiver has rotary tuning

Kenwood Electronics has announced a series of car cassette/receivers with CD changer control and rotary knob tuning. Available in three models, KRC-3006 at $399, KRC-2006 at $349 and the KRC-1006 at $349 (includes speakers) all models offer 25 watt stereo or up to four x 15 watts for parallel speaker applications.

For many years now most car audio component manufacturers have been incorporating pre-set synthesised tuning in their car receivers. Kenwood's research has shown that many users favoured the traditional rotary knob type tuning, and as a result have introduced it into their latest line-up. The rotary tuning facility provides station selection and also doubles up to change CD tracks, by simply pressing the station tuning knob. Kenwood has also included its proprietary ANRC IVFM noise reduction system and multi-path suppression technology, for improved performance in tuning in even weak stations. A total of 18 stations can be stored in memory, 12 FM and six AM.

The KRC-3006 is designed to be used with a CD player such as Kenwood's KDC-C602 multiple-CD player. CD track selection is done via the radio tuning knob.

Both the KRC-3006 and KRC-2006 offer Metal Position/Type IV and High Position/Type II bias setting plus the Dolby B noise reduction. Both these models also offer tape advance and 'repeat' facility.

To suit individual total preferences all models have separate bass and treble, controls, plus loudness switch. For easy to read station location all models also incorporate an amber LCD multi-display readout, with a clock.

For further information on these and other Kenwood car audio products call Kenwood on (02) 746 1888 for your nearest Kenwood dealer.

New automatic 'Slim Palmcorder'

Panasonic has released a new 'Slim Palmcorder' called the A1, which stands for Auto One. It is a fully automatic model, which is ideal for beginners or for camcorder users who want a simple to operate product. On the A1, all the basic functions for recording such as focus, white balance and iris are automatically adjusted for the best picture.

In addition to the 'Auto' mode, the A1 offers two programme automatic exposure modes — 'Sports' and 'Portrait'. The 'Sports' mode is useful for filming fast-moving subjects without blurring, by automatically setting the shutter speed as fast as possible according to lighting conditions.

The 'Portrait' mode creates a picture in which the subject in the centre clearly stands out against a blurred background or foreground, by opening the iris as much as possible according to the lighting condition.

The A1 has a single switch start, which combines the power and recording switch and allows the user to turn the camera on and start and stop recording with one finger. Another user friendly operation is the large on-screen display. Each time the user starts recording, the 'RECORD' appears in the centre of the display screen and 'PAUSE' appears when recording is stopped for easy confirmation.

The A1 boasts Panasonic's one piece aluminium diecast chassis and new 'Digital AI (artifical intelligence) Auto Focus', providing easy and precise operation as well as outstanding durability. It is equipped with 10x power zoom, long play, three lux, five pin editing terminal, date and time functions and a compact 4.8 volt NiCad battery and recharging pack.

The Panasonic NV-A1 'Slim Palmcorder' is available from electrical retailers and specialist camera outlets for a recommended retail price of $1499.

the acquisition of the company by a group of investors late in 1991, and the passing of the company's founder, Dr Jose Bertagni in early 1992.

Major features of the unique planar construction are extremely wide dispersion and highly uniform off-axis response, providing designers and contractors with the ability to design sound systems with excellent spatial coverage while using fewer devices.

The technology employed in each Sound Advance Systems product also provides a totally unseen, architecturally invisible installation with what is claimed as absolutely no sacrifice in performance or technical capability. Most speakers in the range can be painted over or have wall paper applied to them, to provide complete transparency. In fact, Sound Advance Systems patented and proprietary 'in wall' products are configured to completely 'disappear' after installation.

For further information contact the exclusive Australian distributor ESA Audio, 703 Heatherton Road, Clayton South 3169; phone (03) 562 4605.

Compact studio & live mixer

The Soundcraft Spirit Folio Rac Pac is a compact 19" rack-mounted console that combines all the features of a studio mixer, including 28 inputs at mixdown and DAT quality sound, with the special requirements of live performance mixing.

Not only is Rac Pac of DAT quality and virtually noiseless (-129dBu mic amps with 95dB attenuation at fader minimum on all channels), but it is transparent to any source connected. Neutrik connectors give positive contact time after time and Alps pots and faders are used throughout.

The new console can be used just about anywhere with its rugged, free standing design and built-in rack-mount ears. The connector field is located on the rear of the console but it can be repositioned on the underside, which means that permanent set-ups require only 8U of rack space.

Rac Pac provides features normally found only on much larger and more expensive consoles. For example, it has both an insert and a direct out on every mono channel, meaning that you can record multiple sources to multi-track and still connect a signal processor at the same time.

Ten post-fader direct outputs are the ideal solution for feeding digital eight track recorders, for discrete processing of signals in live set ups.

Basic features include comprehensive three band EQ with swept mid range and a high pass filter to cut out stage rumble or mic popping, 48V phantom powering and no less than six aux sends and six stereo returns, so that your effects units don't tie up valuable input strips. There are two stereo inputs with 60mm faders, so you can also connect stereo sources such as keyboard or CD players.

The consoles are available for $2995 (recommended retail) through Jands, Soundcraft's exclusive Australian distributor, at 578 Princes Highway, St Peters 2044; phone (02) 516 3622 or fax (02) 517 1045. ❖

The 16:9 stalemate is finally broken:

NEW WIDESCREEN CTV'S FROM PHILIPS

Widescreen 16:9 television and video may at last be about to 'take off' in Australia, with the release by Philips of its new 28FL2871 and 32FL2881 'Matchline with Superwide' models. Along with a special display mode which allows standard 4:3 video signals to be viewed in widescreen format, the new models provide many other features designed not only to provide the highest performance from current signals, but also to make them as 'future proof' as possible.

by JIM ROWE

It's been clear for some time now that future television and video will have the 'widescreen' aspect ratio of 16:9, instead of the 4:3 ratio we've been watching in Australia for the last 37-odd years. The motion picture industry has been producing virtually all of its features in one of a variety of widescreen formats for almost as many years, and just about everyone has grown to expect and prefer this wider image presentation. It's inevitable that TV and video will have to make the change — the current techniques of adapting widescreen into the 4:3 format by the 'cropping with pan and scan' or 'letterbox' techniques are clearly makeshift, and unacceptable in the long run.

Of course the technology for 16:9 widescreen video has been available for some time, for both transmission and reception. We carried a review of the first Philips widescreen CTV in our May 1992 issue, written by Louis Challis. But growth of the format has been slow, because of a marketing stalemate: broadcasters and video programme producers haven't been prepared to release much software in 16:9, because there were so few widescreen sets to view it on; on the other hand the set makers weren't prepared to start cranking out the widescreen sets in volume, because there was so little 16:9 software available...

It's only in the last couple of years that widescreen has finally begun to move *anywhere*, spurred on mainly by satellite TV and experimental HDTV transmissions in Japan and Europe. It's estimated that there are now over 300,000 Japanese viewers with widescreen/HDTV receivers, while sales of widescreen sets have been steadily building up in Germany, Holland and Scandinavia since satellite transmissions began in earnest. Most of the new direct digital satellite Pay-TV transmissions starting up in the USA this year are expected to be in the 16:9 format.

But in countries like Australia, which are really only now entering the Pay-TV or satellite broadcasting era, the widescreen stalemate has still applied. With only a small amount of 16:9 software available on videotapes and laserdiscs, until now none of the set makers has been prepared to 'get serious' with widescreen sets — and without the sets, the broadcasters and video producers have been unwilling to provide more software.

Now, however, Philips has decided to start the widescreen 'ball rolling' here by adding two new models to its successful Matchline range of up-market, large screen colour TVs. The new sets are the 28FL2871, with a 67cm (28") diagonal screen, and the 32FL2881 with an impressive 76cm (32") screen.

It's expected that the new Philips sets will be joined by models from other manufacturers in the next few months, so Australia finally looks as if it might begin moving towards the widescreen future.

'Superwide' feature

I guess the obvious question to ask is how Philips expects to start selling the new sets, when there's so little 16:9 software around to watch. After all, watching a standard 4:3 PAL picture on a 16:9 screen, with black bands down each side is almost as unsatisfying as watching widescreen movies in 'letterbox' format on a 4:3 screen, with black bands at top and bottom. What has prompted Philips to make the move?

Well, the answer is surprisingly simple: the engineers at Philips (and apparently other firms as well) have now hit upon a way to allow the sets to display standard 4:3 TV/video signals in pseudo-widescreen fashion, with a level of image distortion so low that the average viewer probably won't be aware of it. So the lack of 16:9 software is no longer problem, thanks to a technical 'trick' which lets the viewer watch ordinary 4:3 material as if it *were* in widescreen format.

In Australia, for some reason, Philips is calling this feature 'Superwide'. Elsewhere, both it and the other firms releasing new widescreen sets with the same feature seem to be calling it 'Panorama'.

Superwide/Panorama works by enlarging the normal 4:3 image to fill the full 16:9 screen, as you'd imagine. But this is done as a combination of two distinct techniques, the first of which is simply to enlarge it by about 10% in both the vertical and horizontal directions. As this produces vertical overscan, about 5% of the picture is effectively lost at top and bottom; but this is generally not missed. (The sets allow the picture to be moved easily up and down using the remote control, to allow viewing of subtitles, etc.)

This first phase of the enlargement effectively changes the image aspect ratio from 1.333:1 (4:3) to about 1.5:1. It's the second phase which brings it out to the full 1.78:1 (16:9) ratio, by stretching it in this case *only in the horizontal direction*, by a further 20%. But the real

trick is that this horizontal-only stretching is not *linear* — it's greater at the edges than at the centre.

The official explanation is that the image is subjected to 'parabolic' or 'reverse cylindrical processing'. Inside the set, it seems to be achieved simply by switching out some of the 'horizontal S-correction' capacitors, which are fitted in most large-screen sets to remove the distortion caused when a conically-deflected electron beam is used to scan today's almost flat screens.

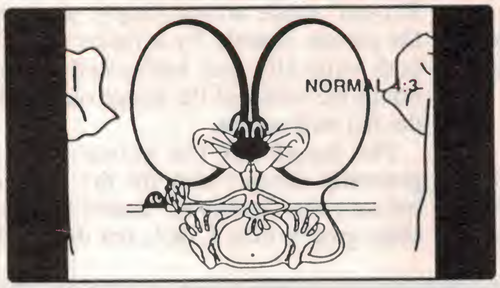
The nett result of this two-stage expansion is that a standard 4:3 image is expanded out to fill the 16:9 screen, with very little obvious distortion.

Other display modes

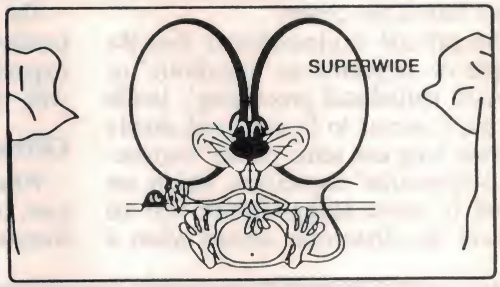
What about movies that are broadcast, or recorded on tape in 'letterbox' format? These obviously can't be handled in the same way, so the new sets still provide an alternative 'Movie Expand' mode which simply expands the picture linearly by a factor of 1.33 both vertically and horizontally. This brings the width of the image out to fill the full widescreen.

The height of the actual image generally doesn't also fill the screen, because the 'letterbox' aspect ratio is often greater than 1.78:1; but the black

New widescreen CTV's from Philips



NORMAL 4:3



SUPERWIDE

Taken from the Philips manual, these diagrams are meant to show the way a normal 4:3 image can be displayed unchanged, or stretched to the full width of the 16:9 screen (right). In reality, the image is also enlarged vertically by about 10%.

bars at top and bottom are generally quite small, and not obtrusive.

In addition the new Philips sets provide a *third* expanded mode, simply called 'Widescreen'.

This is to display genuine 16:9 widescreen software, which has the video information effectively 'squeezed' horizontally by a factor of 1.33, before transmission or recording. So to display this format, the widescreen set must expand the image only in the horizontal direction, and linearly by the same factor of 1.33.

In all, then, the new sets provide a total of four alternative picture display modes: Normal (4:3, with black bands at the sides); Superwide (4:3 expanded and stretched to 16:9); Movie Expand (for letterbox); and Widescreen (for true 16:9 software). With the Philips sets these modes are easily selected in sequence, using a single button on the remote controls.

Enhanced picture

But the ability to display images in widescreen format is by no means the only novel feature of these new sets. In fact it's but one, among many.

For example, like earlier models in the Philips 'Matchline' range the new widescreen sets display the image not at the standard 50Hz field rate, as transmitted, but at *twice* this rate — i.e., 100Hz. This effectively removes all traces of field flicker, as even the most acute human eyes are unable to detect flicker above about 90Hz.

But the new sets go one stage further, and combine 100Hz display with 'digital scan' — a patented technique of dynamic image processing which also effectively eliminates *line flicker*. This is the tendency for parts of the picture detail in a static image area to 'vibrate', due to differences between adjacent lines in the alternating interlaced fields. (With normal interlaced PAL video, all of the 'odd' lines are transmitted in one field, and the 'even' lines in the next.)

With 100Hz digital scanning, the incoming odd and even field video information is digitised and stored in a dual-port memory, at the 50Hz rate (i.e., one field every 20ms). At the same time, the information is read back out and displayed at twice this rate, so that now a complete interlaced odd/even *pair* of fields (a complete frame) is displayed every 20ms.

The complication of this kind of 100Hz scanning is that with moving images, a simple 'doubling up' of each odd/even pair of fields can produce a noticeable strobing effect. To avoid this effect, Philips engineers developed a special processing algorithm whereby the lines of each alternate odd and even *displayed* field are synthesised from information in both the matching line of the previous field of the same type, and the adjacent lines of the *other* field.

The new sets actually have the ability to detect whether the video image is substantially static or moving, and automatically select either the 'plain' or 'processed' 100Hz display algorithms as appropriate. The sets also detect when movies sourced from film are being shown (because there is no movement between each pair of fields), and again select the 'plain' display algorithm.

The nett result of all this is that the sets give an exceptionally stable displayed image, with virtually no field *or* line jitter.

Multi standard, too

Actually, although we've been considering up until now the reception of a 50Hz PAL signal, the new Philips sets are equally capable of processing and displaying a 60Hz NTSC signal, from say a satellite receiver or an NTSC laserdisc. (They'll also receive SECAM signals — a total of 27 different TV coding systems, in fact.) Whichever kind of signal you're receiving, the set automatically recognises the video standard and locks onto it — decoding, digitising and displaying at double the incoming field rate. So NTSC video is in fact displayed at 120Hz, compared with PAL at 100Hz.

Like the earlier Matchline sets, the new sets also provide a picture-in-picture or PIP facility, whereby the signal from a second video source can be displayed in reduced form, in one corner (selectable) of the main image. With the new sets, there's even a second TV tuner 'front end' so you can display a second off-air channel in the PIP frame — and regardless of where it's being sourced from, the PIP signal doesn't even have to be of the same video format. You can have a PAL signal for the main image and an NTSC signal for the PIP image, or vice-versa...

But I digress. Getting back to the area of picture quality, the new sets include a number of *further* enhancements based on the fact that the image is now being continuously digitised, stored in memory and read out again for display.

One of these features is *digital colour transient improvement*, or digital CTI, which is used to enhance the bandwidth of the chrominance information, and ensure that colours don't 'smear' outside the image outlines defined by the higher bandwidth luminance information. Recent sets using conventional analog circuitry have incorporated a simple form of CTI, but by doing the job digitally the new sets can provide a much sharper colour image.

A similar feature is *digital noise reduction*, which uses the set's digital signal processing power to analyse the image luminance information as it is read out of the memory, and delete random variations smaller than a programmable level. This acts like a low-pass filter, to provide a 'cleaner' picture.

Yet another feature of the new sets designed to enhance picture quality is a digital *comb filter*, used to provide improved separation of the decoded luminance and chrominance information — which are effectively 'interleaved' in terms of frequency, for both PAL and NTSC. As a result it becomes difficult to separate high-frequency luminance components from the chrominance by normal analog filtering, giving rise to relatively low frequency heterodyne beats between the two, in the decoded colour information. (This is quite often seen on a conventional set when the picture contains an area with fine vertical or near-vertical rules, such as a coat or blouse with a fine check pattern. On screen it becomes 'alive' with a moving colour interference pattern.)

A comb filter is effectively a large number of bandpass filters, each tuned to a different multiple of the same frequency, and this allows much better separation of the luminance and chrominance. The comb filters used in the new Philips sets are of the '2D' digital delay line type for improved operation, and are automatically changed to the appropriate delay times when either PAL or NTSC signals are being displayed. Not long ago, only the most expensive professional studio monitors had this kind of facility.

There are even more image enhancement features in the new sets, including a 'black stretch' circuit to improve picture contrast, and a 'dynamic astigmatic focus' (DAF) circuit which superimposes a line-frequency parabolic waveform onto the tube focus voltage, to ensure correct beam focusing at the sides of the screen as well as the centre. There's also a *scan velocity modulation* or 'SCAVEM' circuit, which uses an extra coil around the tube neck to modulate the line deflection velocity — slowing the scanning down during white-to-black video transitions, and speeding it up during black-to-white transitions. This compensates for the fact that the tube's EHT capacitance tends to slow down white-to-black transitions, and ensures crisp transient response.

To enable them to take full advantage of all of these picture enhancement features, the new widescreen sets are also provided with improved 'Cineline' picture tubes. These feature a fine-pitch black matrix system, coupled with an Invar shadowmask which allows the use of higher beam current for enhanced brightness and contrast.

All in all, then, the new sets are essentially 'state of the art' in terms of video display technology.

Multiple inputs

To match this display performance, they're also provided with an almost bewildering array of AV input and outputs. This includes no less than FIVE separate and selectable sets of inputs, four of which provide S-Video (separate Y/C) video inputs as well as standard composite video. Four of the sets of inputs are at the rear of the set, labelled Video 1, Video 2, Video 3 and Photo-CD, with the remaining set ('Front') at the front of the right-hand side of the screen. All five inputs include RCA stereo audio connectors, with RCA sockets for the composite video inputs and mini 4-pin sockets for the S-Video inputs.

There are also two sets of AV outputs at the rear, labelled Video Out and Monitor Out. Both include S-Video output as well as composite video, and again stereo audio in both cases.

As if this array of inputs and outputs is not enough, in terms of 'future proofing', I understand that a full digital video input is available as an option, and can be fitted to the sets retrospectively if needed. Apparently the versions of these sets being sold in Europe are already fitted with this option, which comes combined with a SCART input and output.

Oh, and I almost forgot — the sets also include a full Teletext facility, plus a convenient on-screen menu system for making most of the set adjustments. There are also not one, but TWO different remote controls: a full unit with 56 buttons, for adjusting *everything*, and a 'junior' unit for when you only want to change channels, adjust volume, select display mode and video source, and mute the source...

Another feature worth noting is a small preset pot at the rear of the set, which lets you rotate the picture through a small angle, to set it exactly level. The Earth's magnetic field tends to cause a small amount of rotation, depending upon where you put the set, and with a widescreen set any deviation from level is both obvious and irritating. So this is a nice feature.

Surround sound

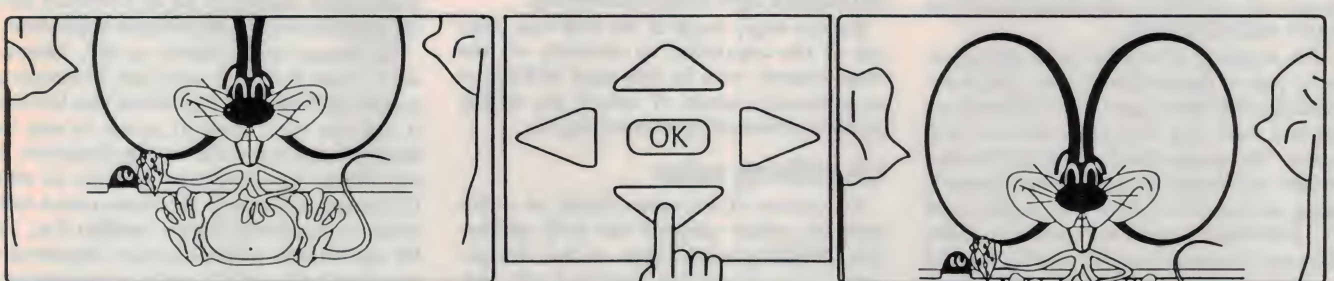
We're rapidly running out of space, but let's look briefly at the sound side of these new sets. Like the picture side, it's very impressive.

As you'd expect, they're capable of stereo reception. Not only that, but they're also fitted with surround sound and Dolby Pro Logic decoding...

Inside the set there are two front 'squeeter' speakers, at the lower left and right corners of the screen. These are driven by 3.5W RMS amplifier channels, and handle the midrange and treble information. The bass is handled by a single subwoofer built into the rear of the cabinet, and driven by a 12W RMS amplifier. Two further 3.5W RMS amplifier channels are provided to drive the optional surround sound speakers, which connect to spring terminals are the rear.

Also provided at the rear are additional spring terminals and a switch, to redirect the main left and right channel amplifier outputs to external front speakers if you wish. In this case the

Continued on page 18



Picture shifted up

Picture shifted down

When the image is being displayed in either Superwide/Panorama or Movie Expand modes, it can be moved up or down using two keys on the remote control unit — to ensure that you don't miss any essential details such as subtitles, etc.

HARMAN/KARDON'S HD7425 CD PLAYER

This month Louis Challis has turned his critical attention to one of a new series of CD players from well-known maker Harman/Kardon, featuring an enhancement technology known as 'real-time linear smoothing' or RLS. This is claimed to give a significant improvement in both transient reproduction and noise performance, making the HD7425 a very interesting player...

When I purchased my first CD player (a venerable Sony CDP 101) 11 years ago, I was initially impressed by the unusual sharpness of the sound. What I initially perceived to be superior sound was soon tempered by a degree of incredulity when I became aware of complaints and the almost uncharitable reaction of many musicians and other relevant commentators.

The initial reaction of Philips, the inventors of the CD concept and Sony, their 'partner in arms', was to discount such criticism. However, that negative reaction soon changed when it was acknowledged that the transient response of that first generation of CD players was less than acceptable when viewed in the context of a faithful reproduction of the original musical material.

From memory, it took Philips and Sony almost a year to accept the criticism and to acknowledge that there was indeed an insidious problem with the first generation of CD players. We subsequently learned that the problem manifested itself as a high frequency ringing on transient signals. The problem was then attributed to the anti-aliasing filters which are interposed between the D-A (digital to analog) converter and the following stages of audio amplification. The sharper the filter cut-off response, then the higher the level of ringing is likely to be in the presence of a signal with a sharp wave front.

The first generation of CD players typically incorporated an anti-aliasing filter with a sixth order response, which proved to be uncompromising and the cause of nasty phase responses within the audible pass band. This filter rolled off at 22kHz, and with the right program content, you could readily identify its insidious spectral and harmonic impact on the recorded material.

To obviate this problem many of the second generation CD players used *oversampling*, of either twice, or four times the sampling rate. This made it possible to transpose the cut-off frequency of the anti-aliasing filter to 44kHz or 88kHz. The fourth and fifth generation of CD players generally went two steps further and adopted eight times oversampling.

By that stage, much of the heat was taken out of the argument, as virtually all the manufacturers were by that stage looking for an alternative means of solving the ringing problem generated by transient signals.

Quantising noise

Of course there were loads of other problems which plagued the early generation of CD players. One of the less obvious problems was that associated with high frequency *quantising noise* produced by the D-A converters.

That noise was also frequently apparent during objective testing. It was certainly detected and criticised by trained or experienced groups of listeners during comparative listening tests, and Marantz introduced a clever marketing program which gained considerable mileage from *their* solution to the problem.

Some aspects of the quantising noise problem were minimised by the switch to 18 and 20-bit converters. The problem was further minimised by changes in the oversampling technique, as much as they were by related improvements in the anti-aliasing filters.

Around 1987, the Philips Research Laboratories in Eindhoven developed the Bitstream converter. Although it may be hard to accept, for quite some time Bitstream converter chips seemed to be an invention seeking a practical and cost-effective application.

Of course 'where there's a will, there's a way', and it didn't take the commercial people at Philips long to realise that the best, if not the most obvious place to use the Bitstream converter was as a replacement for the 'ladder' type converters used by all other CD players at the time. Bitstream uses a technique of converting binary samples (i.e., 16-bit words) into a one-bit code representing two levels (0 and 1), using oversampling, noise shaping and pulse density modulation (PDM). The bit stream thus created is converted into an analog signal using a switched capacitor bit-converter circuit.

There are of course other variations of this concept, as typified by the MASH (Multi Stage Noise Shaping) system developed by Nippon Telephone and Telegraph (NTT) of Japan, and other similar concepts which convert the binary data samples into a data stream representing more than two levels.

In theory each of those forms of detection should end up providing a more linear acoustical output, particularly at low signal levels. But in practice there are a myriad of other unexpected problems involved with the adoption of Bitstream conversion. One of the most significant of those problems is the generation of a new form of high frequency noise in the analog output signal.

Each manufacturer's R&D section adopted a slightly different approach to resolving this problem. As is to be expected, each manufacturer also goes out of their way to assure you that their solution is the best.

Last year I reviewed Pioneer's 'Legato Link' system, which embodied an innovative and very practical concept to minimise the ringing effects of the anti-aliasing filter. I was full of praise for the system, but I was nonetheless critical of the way in which it was described in their technical literature, and the way it was presented by Pioneer's marketing people in Japan.

H/K's approach

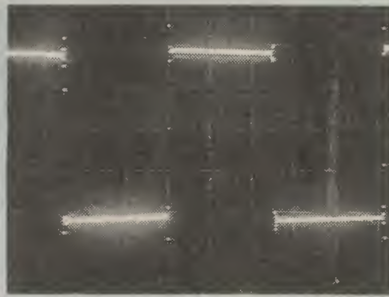
The latest CD player to reach the magazine for review is the Harman/Kardon HD7425. This uses a 'Bit Stream' D-A conversion system, supplemented by two significant technical advances designed to control the problems of high frequency noise and anti-aliasing filter transient ringing.

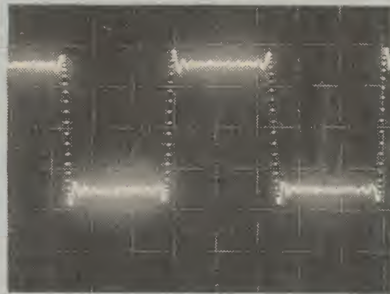
The first of those advances is the adoption of a 'Real Time Linear Smoothing' circuit (abbreviated to RLS), which smooths the quantising transition in the digital waveform immediately after the D-A converter (see Fig.1). The underlying concept of this circuit is that if the digital signal can be effectively smoothed in the course of each of those transitions between the digital samples, then the two primary problems of high frequency noise and the need for a sharper low pass filter (with its associated liability of unwanted phase shifts within the audible domain) are simultaneously addressed.

The Harman/Kardon approach incorporates three steps. The first is an eight times oversampling digital filter, which provides second-order interpolation capability. This approach ensures a smoother interpolation of the individual steps, so as to more closely follow the curvature of the original analog signal. Harman/Kardon claim that this is preferable to forming a straight line between each successive point on that 'steps and stairs' waveform, and I support that view.

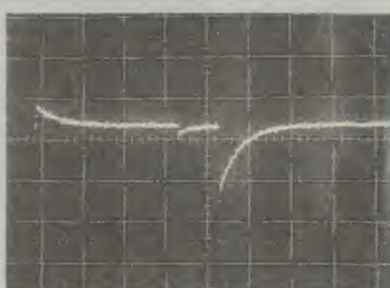
The second step is the provision of an analog slope generator (ASG). This circuit apparently creates accurate analog waveforms to further attenuate the residual digital 'steps and stairs' which are a fundamental property of the D-A conversion.

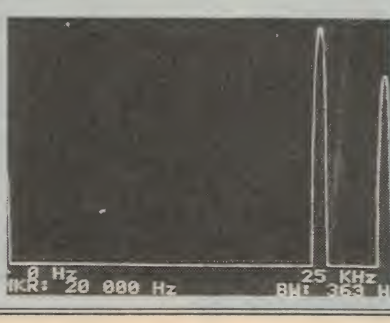
The third step, and the one which I regard as being potentially one of the most important, is the adoption of a *single pole* analog low-pass filter after the D-A converter. This simple filter avoids the unwanted and audibly disturbing non-linear phase characteristics, which are one of the most disturbing features of multi-pole filters of the type used by so many other CD players.





At top is the measured squarewave response of the HD7425 player at 100Hz, taken using the Denon test disc 38C39. Above is the response with a 1kHz squarewave, taken with the 'Hifi News' test disc II.
Opposite: Pictured is the HD7225 player, which is the 'big brother' of the HD7425 but virtually identical in appearance.
Below: The upper plot shows the player's impulse response, as measured using the CD-V12 test disc (X scale 200ms/div); the lower plot shows the alias signal generated when a 20kHz signal is replayed from the Denon test disc, as plotted via an FFT analyser.





Of course that approach has the potential to introduce other insidious liabilities, which the Harman/Kardon literature fails to mention. The most significant of those is the prospect that the CD player will generate significant alias frequencies in its output. Those automatically manifest themselves in the 22 - 30kHz region.

You can't hear those components, because few people can hear anything above 18kHz. But they will nonetheless appear in both the amplifier as well as in the speaker circuitry, and could in theory give rise to an added risk of intermodulation distortion products being generated as a result of their presence. Where the amplitude of the signal is high, the risk of that possibility is further increased.

In the event that there are any traces of electronic signals encoded on your CD which fall within the critical 22 - 30kHz frequency domain, then they will manifest themselves as alias frequency components — which will then be reflected back into the 14 - 22kHz region. Those components *would* be audible; but more about that later.

The Harman/Kardon HD7425 is a visually smart and attractively designed CD player. Its most striking feature is the designer's adoption of a central curved element in the front face, extending for the full width of the unit. This curved section incorporates the power switch at the left hand end, the front face of the disc drawer (which accepts either full size or 8cm diameter discs), the display module and the main disc control pushbuttons. The latter are configured in two rows at the right hand side of the display.

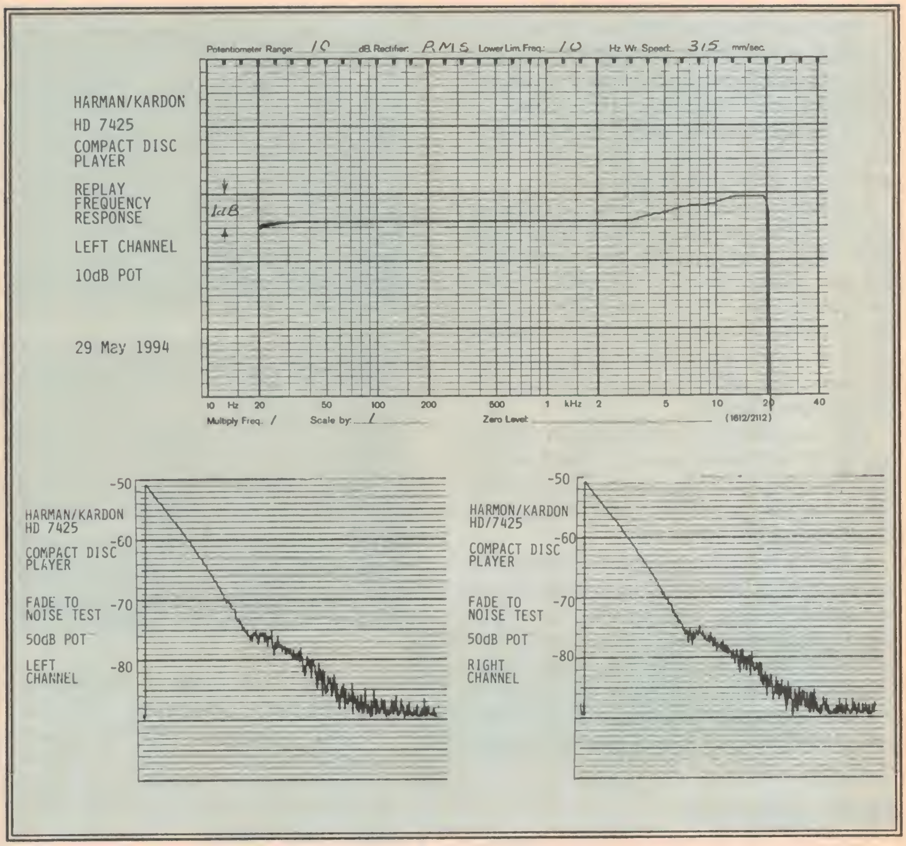
Three additional controls are provided as a separate group below the left hand end of the main control buttons. These are a DISPLAY 'on/off' button, a TIME button which selects the format in which disc information is presented by the display, and a PROGRAM button which puts the CD player into the program mode and which allows a selected set of tracks to be played in a user-specified sequence.

The rear of the CD player has a pair of conventional fixed level analog output sockets for left and right channel, and an RCA co-axial output socket for the digital signal. All of the normal control functions are duplicated on the remote control, which does not provide signal output level control.

On opening up the case of the HD7425 player, I was immediately struck by the simplicity of the electrical design. It uses one main motherboard with loads of transistors, capacitors and resistors, and seven modestly sized ICs on a well constructed printed circuit board with a separate ribbon cable connected to the front panel mounted display and control switch module.

The method of construction is neat, effective and provides for simplified maintenance,

should it ever be required. The disc drive and laser assembly are very cleverly designed, and use a composite steel and plastic structure to ensure stiffness and optimum linear tracking of the three-beam laser pickup assembly.



At top is the measured replay frequency response of the HD7425. Note that the plot has an expanded vertical scale — the rise in response above 3kHz is really quite small. The lower plots show the 'fade to noise' test results.

Objective testing

It was obvious that there would be some potential for measurable performance differences between this CD player and others which we have recently reviewed. So we put the HD7425 on the bench, gathered the ensemble of test discs required, and commenced the objective testing.

The first and most obvious difference was that whilst its frequency response was ruler flat from 20Hz to 3kHz, it exhibited a rather unexpected gentle rise in the frequency response between 2kHz and 12kHz. The rise was only a modest 0.7dB (which you would not hear), but it would appear that it may well be associated with the single pole anti-aliasing filter.

Following the rise to 12kHz, the response is then followed by a further slightly elevated plateau which extends up to 20kHz. Above 20kHz the response drops away quite gently, although proof of that required a different analysis system as the available CD test discs do not provide information through which that parameter may be conveniently graphed, or for that matter even viewed.

In order to determine the replay frequency characteristics of the low pass anti-aliasing filter circuitry in the region *above* 20kHz, I examined the CD player's output with a wideband FFT analyser. The FFT's display was examined whilst simultaneously viewing the replay of a gliding tone in the range 15kHz to 20kHz.

What we observed was that when the test signal reached 19kHz, the rising alias signal was readily visible at just under 25kHz. The level of that alias signal was approximately 15dB below the level of the fundamental input signal of 19kHz.

As the frequency of the input signal rose further towards 20kHz, the alias signal approached from the other direction. This is precisely what I would have expected on the basis of my assessment of the Pioneer 'Legato Link' system, which produced a similar response.

I repeated the test with the test disc which I had produced to evaluate the 'Legato Link' player, which incorporates signals which extend beyond the normal 22kHz cutoff frequency. Not surprisingly, when the signals extend beyond 22kHz, the alias components are reflected back into the audible domain, and the FFT displays the rapidly drooping alias components climbing within the CD player's audible band output.

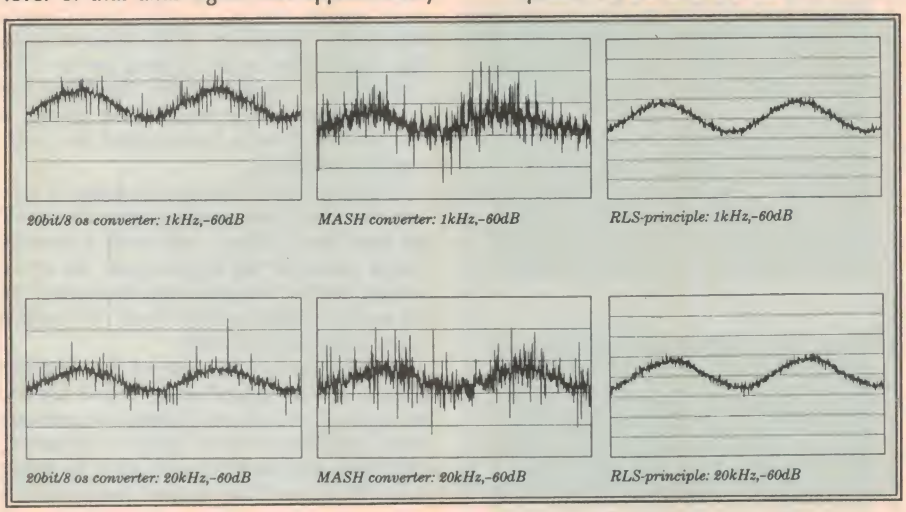


Fig.1: Plots produced by Harman/Kardon to illustrate the significant reduction in digitising noise achieved using its real-time linear smoothing (RLS) system (at right). Shown for comparison are the outputs from a 20-bit eight times oversampling converter (left) and a mash converter (centre).

These characteristics do not constitute a significant liability or disability, because by and large, the CDs which you purchase will not contain significant output above 20kHz. The reasons for this are simply that during the recording process the recording chain deliberately attenuates those components, to minimise such problems.

The second series of tests which I performed were an evaluation of the D-A conversion linearity. In the range 0dB to -60dB, the conversion linearity is almost perfect. In the range from -60dB down to -90dB on the left channel, the conversion linearity was excellent. The right channel however, did not perform quite as well; from -75dB down to -90dB the conversion linearity of that channel was relatively poor.

I was intrigued by these results, for although they provided a means of assessing the high level linearity of the CD player, there is another aspect which is potentially more significant — especially where the player incorporates 'bit-stream' technology.

The conventional test signals at fixed levels don't really provide an appropriate means of

MEASURED PERFORMANCE OF HARMAN/KARDON HD7425 COMPACT DISC PLAYER Serial No. 5241-02574

1. Frequency response — 20Hz to 20kHz +/-0.7dB

2. Linearity @ 1kHz

Nominal Level	L.Output	ROutput
0dB	0.0	0.0
-1.0	-1.0	-1.0
-3.0	-3.0	-3.0
-6.0	-6.0	-6.0
-10.0	-10.0	-10.1
-20.0	-20.0	-20.0
-30.0	-30.0	-30.0
-40.0	-40.0	-39.9
-50.0	-50.0	-50.0
-60.0	-60.1	-59.9
-70.0	-70.6	-69.9
-80.0	-81.0	-77.7
-90.0	-88.9	-81.7

3. Channel Separation

Frequency	Right into Left dB	Left into Right dB
100Hz	-90.0	-89.0
1kHz	-89.6	-89.4
10kHz	-85.2	-86.5
20kHz	-79.5	-78.5

4. Distortion @ 1kHz

Level	2nd Actual	3rd Actual	4th Actual	5th Actual	THD%
0	-90.2	-86.6	-97.3	-94.7	0.006
-1.0	-87.9	-86.0	-98.0	-93.3	0.007
-3.0	-88.8	-91.6	-99.6	-94.3	0.008
-6.0	-87.8	-85.6	-102.7	-	0.007
-10	-82.1	-87.9	-	-	0.009
-20	-86.2	-93.4	-	-	0.006
-30	-	-64.7	-72.5	-67.3	0.07
-40	-	-62.4	-	-	0.075
-50	-	-60.9	-	-60.1	0.13
-60	-	-48.1	-	-51.8	0.47
-70	-	-	-41.4	-32.6	2.4
-80	-	-	-	-30.3	3.0
-90	-	-21.6	-	-21.8	12%
Distortion @ 100Hz					
0	-90.0	-90.4	-96.3	-93.8	0.005
-20	-	-95.1	-101.9	-105.1	0.002
-40	-77.6	-65.9	-84.6	-63.7	0.08
-60	-54.8	-41.0	-57.1	-51.5	0.96%
Distortion @ 10kHz					
0	-34.8.2	-	-	-	1.8%

5. Emphasis

Frequency	Recorded Level	Output Level (L)	Output Level (R)
1kHz	-0.37dB	-0.3	-0.3
5kHz	-4.53dB	-4.1	-4.0
16kHz	-9.04dB	-9.1	-9.4

6. Signal to Noise Ratio
Without emphasis 92.2 (Lin) 99.9dB(A)
With emphasis 95.2 (Lin)100.8dB(A)

7. Frequency Accuracy
Reference Frequency (19.999kHz) — Measured Frequency -3Hz

8. Square Wave Response
100Hz Square wave = good response
1kHz Square wave = good response

9. Impulse test
Time base = 1.0ms/div
Photograph using Tektronix digital CRO
Settings — Vertical amplifier = 1mV/division

10. Dirty record test
Interruption Information layer
Tracks all levels up to 900 micrometres on Philips Test Disc
Tracks all levels up to 2000 micrometres on Challis CBS Test Disc No.1

11. Black dot at read out side
Tracks all dot sizes up to 800 micrometres on Philips Test Disc

12. Black strip test
Plays all music up to 2200 micrometres on Challis CBS Test Disc No.2

13. Sinusoidal vibration test
Optical system mistracks when acceleration level reaches 0.3 'g' RMS

assessing the impact of *quantising noise.* By contrast, a 'fade-to-noise' test signal neatly provides such means. The same fade-to-noise test signal simultaneously provides a delightful means of assessing how well the RLS circuits resolve those nasty little problems which plague the more conventional ladder type D-A converters.

When I plotted the fade-to-noise signals for both the left and right channels, I discovered that the Bit Stream converter and its associated RLS circuit work very well down to -75dB. But below the nominal threshold of -75dB the quantising noise is almost immediately detectable, and soon makes its presence really felt, as the signal level fades even further.

The logarithmic fading signal is supplemented by the quantising noise, and what you then observe is a curvature in the signal — which is in good agreement with the classical mathematical relationship for a logarithmic decreasing signal to which is then added a supplementary fixed level of nominally random noise.

The absolute noise threshold measured in this way is close to -90dB, which conforms reasonably well with our separate measurements of unweighted signal to noise. What is equally relevant is that the quantisation noise is so low when compared with the dynamic range of the system, that even if you had perfect hearing, you would still be hard pressed to detect this component of noise — even if you were to put your ears right up to the face of your loudspeakers. The A-weighted signal to noise ratio of the CD player is just under 100dB(A), which is particularly good.

The inter-channel separation is excellent at 100Hz, good at 1kHz and 10kHz, and is still more than adequate at 20kHz. The distortion characteristics are good all the way down to -60dB, beyond which the distortion climbs rapidly so that by the time the signal level drops to -90dB, you have more than 10% distortion. Those distortion components would however be inaudible and thus do not constitute a problem.

The frequency accuracy of the player is -3Hz with a 19.999kHz test signal, which is good, and the square wave and impulse response characteristics are also particularly good.

Although the RRP of this CD player is well under $1000, it performs as well, if not better than most CD players selling at twice the price in terms of its ability to cope with black dots, black stripes and finger prints. It tracked perfectly with all the standard test material, and only succumbed to a black stripe 2.2mm wide — which is a particularly brutal test.

The last formal test we used was the sinusoidal vibration test, which is performed at 40Hz. The CD player's transport mechanism coped well with vibration levels as high as 0.3G RMS, at which point mistracking occurred.

Taken overall, then, the objective performance of the HD7425 CD player ranged between good and excellent in all the major departments.

Subjective testing

The subjective evaluation of the HD7425 was rewarding, and confirmed characteristics which I had anticipated on the basis of the objective testing.

The first disc I used contained significant high frequency transient material, which was appropriate to evaluate the high frequency transient response of the CD player. It's a new demonstration disc called 'Sheffield Drive' (Sheffield Lab 10037-2), and is a good example of the latest generation of 'pot-pourri' demonstration discs whose content have been carefully selected to display either the best (or in some regrettable cases the worst) characteristics of a hifi system.

Track 2 on this particular disc features James Newton Howard, in 'Slippin' Away II'. Howard's rendition of 'She' in the 1980's was regarded as being one of the finest instrumental demonstration tracks for evaluating studio monitor loudspeakers, and 'Slippin' Away II' is of a comparable genre. It gently but delightfully incorporates high frequency transients and a host of other acoustic instrumental information, which is perfectly suited to an evaluation of this type.

The HD7425 responded beautifully, and the music that it produced confirmed how well Harman/Kardon's RLS and ASG circuits perform with transient content musical material that is acoustic in origin rather than electronic.

If I had needed any convincing before hearing this disc (and comparing its output with my existing CD player), then I most certainly now had the evidence that the RLS circuitry and the single-pole high frequency filter display significant audible attributes.

I proceeded to another new disc, 'The First Placido Domingo International Voice Competition Gala Concert' (Sony Classical SK 46 691). This is a live recording from the Gala Concert in Paris in 1993, and presents singing and musical presentations by Placido Domingo together with four of the prize winners in the competition singing excerpts from famous operas.

The human voice provides material with which most listeners are familiar, and in which deficiencies or nuances are readily detectable. It also provides some first class singing, backed by outstanding orchestral music from the Opera of Paris-Bastille.

This disc has been 'Super Bit-Mapped', carefully recorded and exceptionally well presented. It provided further confirmation that the HD7425 has gained useful detectable advantage in the frequency range from 4kHz to 15kHz.

The last disc I used for my evaluation was a recently released original sound track recording entitled 'Thirty Two Short Films About Glenn Gould' (Sony Classical SK 466 86). I must acknowledge that I am a Glenn Gould fan, and he is now regarded as being one of the geniuses of his time. Whilst best known for his renditions of Bach, this particular disc provides a delightful pot-pourri of 23 individual extracts from Bach, Wagner, Beethoven, Sibelius, Prokofiev, Scriabin and others.

Although some of the original recorded material was transcribed from analog tapes, the disc provides exciting piano recital material with which to evaluate the CD player and the following system, particularly at normal or elevated listening levels. This recording when coupled with the HD7425 player provides realistic, almost true to life sounds which are as moving as the music itself.

Summary

The Harman/Kardon HD7425 is an attractive and well designed CD player whose major attributes are superior fidelity, and simple and straightforward use.

I admired all of its characteristics bar one, which was the lack of a volume control on the remote control. If the remote control had incorporated this one extra feature, I would have given it a mark of '10 out of 10'.

The HD7425 measures 442mm wide, 326mm deep and 92mm high, and has a weight of 4.7kg. It has a quoted RRP of $799.

For further information contact the Australian distributor for Harman/Kardon, Convoy International of 400 Botany Road, Alexandria 2015; phone (02) 698 7300. ❖

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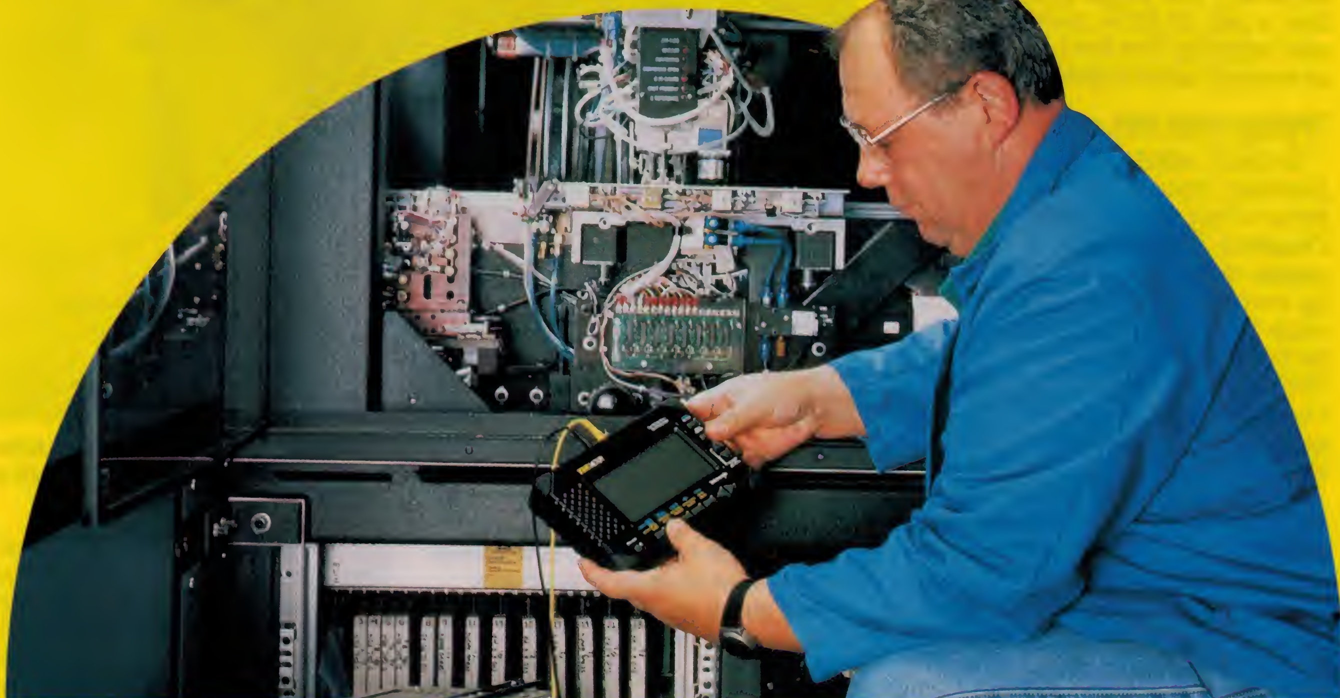

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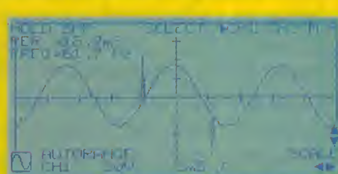

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READER INFO NO. 4

New widescreen CTV's from Philips

Continued from page 11

amplifiers can supply 2 x 12W RMS into 8-ohm loads. (All of these power ratings are for 0.7% THD.)

For those who want even better surround sound, to take full advantage of the Dolby Pro Logic system, there is also a pair of RCA connectors at the rear supplying line-level audio to drive an external stereo amplifier.

Trying one out

So that I would be able to give you a first-hand report of the performance of the new sets, the nice people at Philips Consumer Products had one of the 32" models delivered to my home, and set up correctly. (A full installation and setup by Philips is actually part of the package with these sets, by the way.) This let my family and I form a realistic evaluation of the value of those umpteen new features and facilities, for almost a week.

I'll be frank: the 32" Matchline/Superwide set is one BIG receiver. It measures 836 x 591 x 593mm, and weighs a massive 55kg. We didn't have a stand or base solid enough to put it on, so it spent its few days with us resting on the floor...

We tried it with normal off-air TV signals, with movies from PAL VHS tapes, and with some demo and movie material from NTSC laser discs, kindly supplied by Philips. One of the demo discs even had both standard 4:3 NTSC and 16:9 widescreen NTSC versions of the same sequences, so we could directly compare the 'Superwide 4:3' and genuine 16:9 widescreen formats.

For some of the tests we used the set's internal speakers with only the optional external surround speakers. For others, we used external front speakers as well. For one test using a movie on laserdisc with Pro Logic sound, I also hooked it up to my stereo system, for 'the works'.

And the verdict? In a nutshell, this set undoubtedly provides a level of home video and sound presentation which is *very* impressive indeed. So much so, that it has spoiled us permanently, for watching on any ordinary sets.

The picture clarity, contrast and stability really are excellent, and the widescreen presentation really does provide the 'missing link' when it comes to satisfying home viewing of movies. Coupled with the 100Hz digital scanning and surround sound, you certainly

TV comedy duo 'Roy Slaven and H.G. Nelson' pictured with a 76cm receiver at the official Philips launch of the new widescreen model CTVs. As you can see, they look suitably impressed.

get very close to a true 'first release cinema' level of image presentation.

How about that Panorama/Superwide trick, to turn normal 4:3 video into pseudo 16:9 — was there any obvious distortion? Well, at first you're aware that people become slightly more 'plump', and a little more full in the face. When the camera pans around a scene you also tend to notice the same kind of effect you get when a short focal length camera lens is used, where object seem to be closer to you when they're at the edges of the picture, and move away a bit when they move through the centre.

But these effects are really quite minor, and you soon get used to them. Basically you tend to simply settle back, and enjoy the widescreen presentation.

Actually because there was so *little* apparent distortion, I was curious to look more closely at the exact effect of that 'reverse cylindrical processing'. Unfortunately there wasn't a standard test pattern being transmitted, for all the time I had the set, so I had to rely on a fairly elderly mono test pattern generator. Strangely enough, even using the fine vertical line pattern the horizontal expansion in Superwide mode seemed to be so close to linear, that I couldn't see any real evidence of controlled nonlinearity. I'm confused, I admit.

Basically, though, I must summarise the performance of the Philips 32FL2881 'Matchline with Superwide' as outstanding. The only real problem with it, as far as I'm concerned, is the price: the RRP is an equally outstanding $6299 — well over double the current price of ordinary 'large screen stereo' receivers. The price *does* include installation and setup by Philips, of course, but all the same it's well beyond the budget of most of us. Which is sad.

Still, to those fortunate few who *can* afford one, it's not only a great performer, but a set that should last you for quite a while — thanks to all of those state-of-the-art features and built-in 'future proofing'...

My thanks to George Sprague, Geoff Billingsley, and Alan Williams of Philips for the generous assistance they gave me in preparing this review. ❖

TELECOM'S NEW PAY-TV NETWORK - 2

In the first of these articles we looked at the way the pay-TV cable network and set-top units operated. In this article we discuss the various techniques that pay-TV operators can employ to stop unauthorised viewers watching their programs. Although most people would call these techniques *scrambling*, there are in fact two distinct processes — encryption and scrambling — which need to be considered.

by JIM DAVIS

Let's consider *encryption* first. When a customer requests to view a pay-TV program, the head end needs to send a signal to the customer's set-top unit to authorise viewing of that channel. When addressable set-top units were first introduced in the 1980's, the head end usually sent messages to the set-top unit by modulating digital data onto a carrier frequency of 106.25MHz, at the top of the FM band.

Today, more sophisticated methods are used to send messages to set-top units, often during the horizontal blanking period — say by varying the width of the sync pulse, to signify '0' or '1'. Another method, used by both Scientific Atlanta and Jerrold, is to modulate the data onto the sound subcarrier (Diagram 3).

In order to stop viewers sending their own messages to the set-top unit to authorise viewing of a channel, the digital signal must be encrypted at the head end before being transmitted. To further make pirate decoders harder to make, the encryption algorithm needs to be changed frequently — without going to the trouble of sending a technician to every home. That is, changing of the encryption algorithm must be performed remotely from the head end, using parameters that are selected by a computer without operator intervention. Many pay-TV companies change the encryption algorithm several times each month.

Most set-top unit manufacturers now use a 'Public Key' cryptosystem to encrypt the digital data sent by the head end to each set-top unit. The use of public keys allows the pay-TV operator to change encryption keys frequently with minimal security problems.

Scrambling methods

Now that we have described how the head end sends encrypted data to each set-top unit, we can look at the *scrambling* of TV signals. There are several methods of scrambling currently in use. Each line of a TV picture needs to be 'in sync' for a complete picture to be built up. A negative-going pulse, called a *sync* pulse, is placed at the start of every line on a TV signal to indicate the beginning of the line. An effective way to scramble TV signals would be to alter these sync pulses, and for the head end to transmit to each set-top unit information on how the sync pulse is to be recreated.

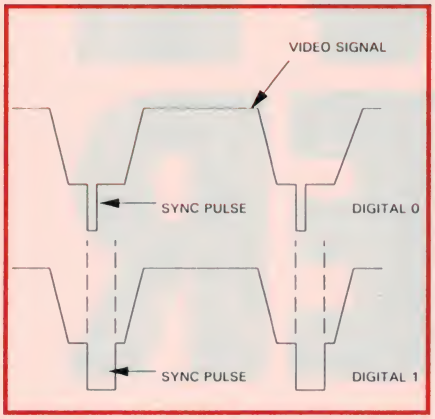


Diagram 3: Digital information can be superimposed on the Pay-TV video signal by varying the width of the horizontal sync pulses. Using this method a data rate of 15,625 bits per second can be achieved.

One method of altering the sync pulse is to attenuate or suppress the pulse entirely (Diagram 4). Sophisticated methods attenuate the sync pulse by a different amount on each line. Another more effective way of altering the sync pulse is to add a large amplitude sine wave, at the line frequency of 15.625kHz, to the carrier (Diagram 5). Since the TV set will try to lock on to the most negative part of the incoming TV signal, thinking that this is the sync pulse, it will instead lock on to the most negative part of the added sine wave, effectively scrambling the signal.

Most modern TV receivers, however, are able to recreate a distorted sync pulse without too much difficulty — there being enough repetitive information in the TV signal for the sync circuitry to lock on to. As a result scrambling systems that only distort the sync pulse are easily foiled and are not considered effective by pay-TV operators. If sync distortion is used today by a cable operator, it is always in conjunction with other more secure scrambling methods.

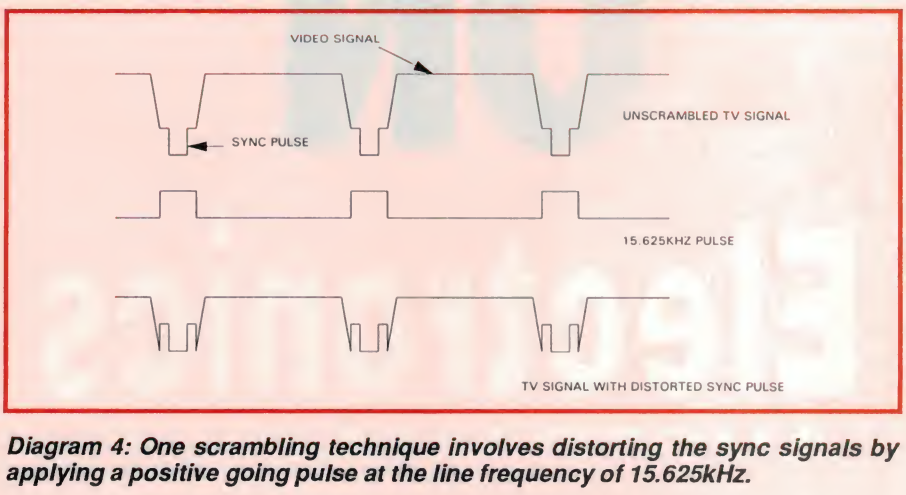


Diagram 4: One scrambling technique involves distorting the sync signals by applying a positive going pulse at the line frequency of 15.625kHz.

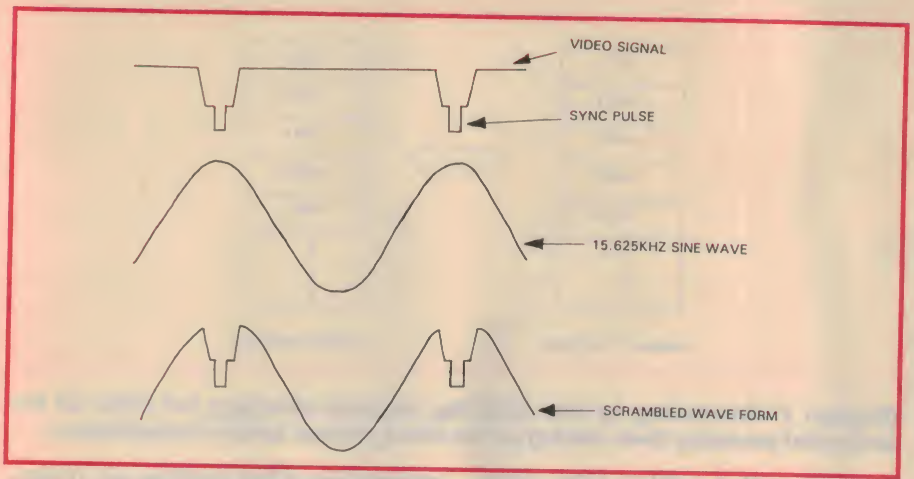


Diagram 5: Another method of distorting the sync pulse is by applying a large sinewave, also at the line frequency of 15.625kHz.

Another method of scrambling a TV picture is to invert the video signal before transmission and to re-invert the signal at the set top unit. Also, the colour information in the TV signal can be phase changed before transmission.

A more modern method of scrambling is 'cut and rotate'. With this technique each line of the transmitted TV signal is divided in two and the position of the two halves swapped before transmission (Diagram 6). The position of the cut is changed on a pseudo-random basis for each line, and it is again up to the set- top unit to reverse the cut and rotate operation performed at the head end, to restore the picture.

One of the advantages of cut and rotate is that the TV signal can be descrambled with minimal distortion of the original signal. Most other scrambling methods distort the signal during the scrambling and descrambling process.

Cut and rotate is the scrambling method used in MAC, the satellite broadcast and cable TV standard defined by the European Broadcasting Union. The MAC standard defines 256 cut points where the TV signal lines can be cut for rotation.

Although the cut and rotate method used by the MAC system is called *Eurocrypt*, there are two other scrambling systems with similar names: *Videocrypt* and *Videocypher*. Videocrypt is used by the British Pay-TV satellite BSkyB, and performs cut and rotate on a PAL signal.

REFERENCES

There are two good books on pay-TV:

1. *Cable Television Technology*, by James N. Slater (Ellis Horwood Limited).
   This is a very readable description of pay-TV written from the UK viewpoint. Well worth reading for those interested in gaining a good understanding of pay-TV systems.
2. *Cable Television Technology & Operations*, by Eugene R. Bartlett (McGraw-Hill, Inc.).
   This is an American book describing pay-TV systems in the US. The book is considerably more technical than *Cable Television Technology* and requires some maths to understand the explanations.

Videocypher is a US standard that replaces the sync signal with a digital stream which contains both digital audio and digital data. In addition to altering the sync pulse, Videocypher also performs video inversion and alters the colour burst.

Line shuffling is also a popular scrambling method. Before transmitting a TV frame, scrambling equipment at the head end will shuffle all of the 625 lines that make up that frame. Thus, line shuffling effectively scrambles an entire frame before transmission, unlike the other methods that scramble TV signals on a line by line basis. (Diagrams 7, 8.)

The last two scrambling techniques described, cut and rotate and line shuffling, are today regarded as the most difficult to break.

To be effective, set-top unit manufacturers use a combination of all scrambling methods and send encrypted digital messages to all of the set-top units to indicate, on a real time basis, which method or combination of methods is currently being used. As an example, a set-top unit designer could choose two scrambling methods, A and B, to be active at alternate times. A could be sync suppression, while B could be video inversion.

If the scrambling method currently active is A, when there is a change of scene in the picture both the head end scrambler and the set-top unit would switch simultaneously to using method B. On the next scene change the scrambling method will go back to A, and so on. The system is designed to change scrambling methods during a scene change so that viewers will not notice the picture flicker when changing from A to B. The only time that the head end would send a message to set-top units giving information on scrambling methods would be if the scrambling method were changed. This technique is currently used by a leading set-top unit manufacturer.

Sound scrambling

So far we have only discussed scrambling the TV picture. Most operators today agree that to be effective, the sound signal also needs to be scrambled. One way of doing this is to insert a large amplitude signal at a frequency near the sound subcarrier. The TV's sound detector will then lock on to this larger 'decoy' signal and not the sound subcarrier. The set-top unit can be authorised by the head end to remove the decoy signal before the Pay-TV signal is passed to the TV receiver.

Scrambling though is not intended to make a picture *totally* unintelligible. Ideally the picture is distorted just enough to make viewing extremely difficult, while still allowing the customer to make some sense out of the picture. This is done to whet the appetite of the potential customer, so that they will contact the pay-TV operator to arrange a subscription.

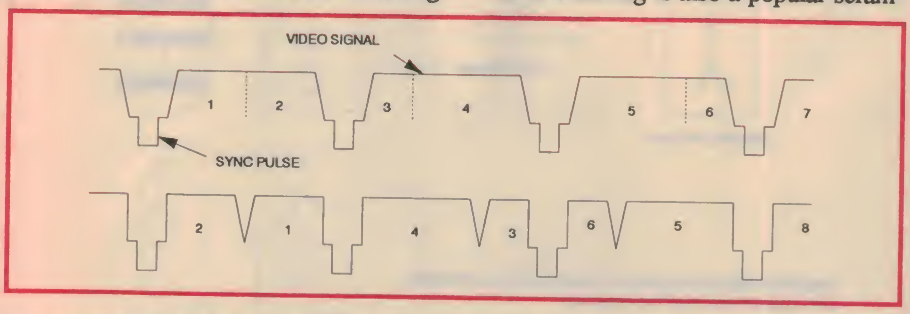


Diagram 6: A different scrambling technique is the 'cut and rotate' system, in which each line of the video signal is split into two in a pseudo-random fashion. The two halves of the signal are then swapped or 'rotated' before transmission.

Pay-TV Network

As described earlier, the head end periodically sends to each set-top unit a message telling it the type of scrambling that is currently being used. But suppose the customer had temporarily disconnected his set-top unit during the time that this message was sent. The customer could always phone the service provider to ask that the unit be updated immediately with current scrambling information.

In order to overcome some of these problems and to identify broken units before the customer complains, many operators continually poll, at least once every day, every set-top unit in their network. If a set-top unit does not respond to polling, the identity of the unit is placed in a table called a Silent List, which records all set-top units that are not responding. If a unit remains on the list for more than a few days the pay-TV operator can phone the customer to determine if there is a problem.

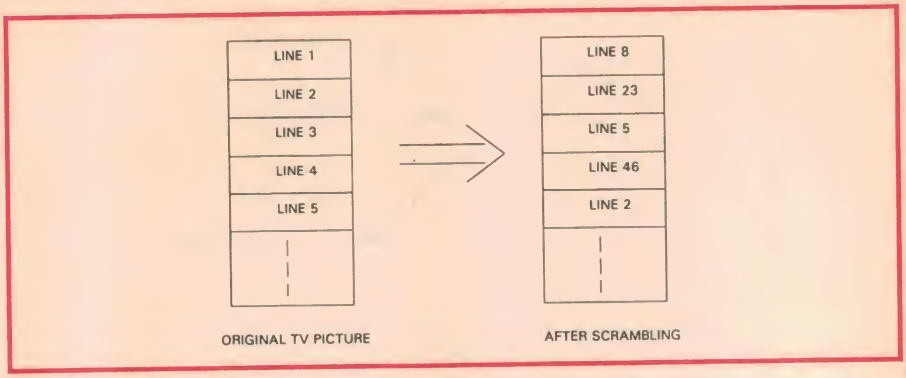


Diagram 7: Scrambling by line shuffling involves changing the order of the horizontal scanning lines making up the video picture, before transmission.

Smart card system

Although most pay-TV equipment manufacturers have implemented set-top units using — more or less — the same design philosophy, the French electronics company Sagem has developed an innovative system called *Syster* that is used widely in Europe. When a customer subscribes to a pay-TV service that uses Syster he is given a set-top unit plus a smart card to plug into the set-top unit.

The advantage of Syster is that each set-top unit in the network is identical. However each smart card is unique to that customer and contains all the addressing information needed for the head end to communicate with the customer's set-top unit. When a customer plugs in a smart card, it takes a maximum of three minutes for the head end to validate the card and update it with new scrambling information. After that, scrambling information is updated every two seconds.

The set top unit will not work unless the smart card is inserted. Syster uses a combination of line shuffling and, optionally, cut and rotate to scramble pictures.

To make unauthorised descrambling of TV signals even more difficult, set-top unit manufacturers use only proprietary ICs in their equipment — so that pirate decoder manufacturers cannot buy the chip sets used. To stop people looking inside the set top unit and measuring signal waveforms etc, some manufacturers place an electrical switch in the set-top unit box assembly. If you open the box, standby battery power is disconnected to some PROMs and the contents are erased. This makes playing with set-top units very difficult.

In order to sum up scrambling and pay-TV, I would like to make the following point. All set-top manufacturers say that *their* scrambling method is the best, and is 'virtually unbreakable' by the hacker. In reality, as experience in the US and Europe has shown us, scrambling and hacking are continually in catch-up mode. Perhaps a year after a new scrambling method has been introduced, the skills to break it have generally been developed by hackers.

Until the introduction of digital TV, pay-TV will continue to be vulnerable to those with the necessary skill and perseverance to attack it. ❖

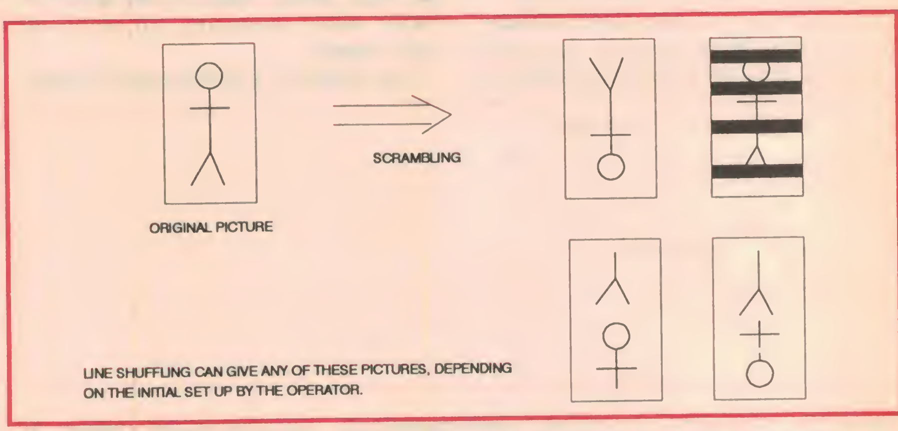


Diagram 8: Depending on the way in which line shuffling is done, the scrambled picture can take on various appearances.

An Intelligent Listener's Guide to

UNDERSTANDING THE SHORTWAVE RECEIVER - 2

In the first of these articles we described the amazing things a modern shortwave receiver can do, and how they go about it. Hopefully that got you all drooling and slavering to explore the shortwave bands with renewed intensity, armed with knowledge of how to extract elusive signals from a sea of radio debris by the clever use of gain and filters. This month we will continue in a more practical vein. We'll also look at some receivers on the new and used markets, and finally at antennas. Well, one antenna, anyhow.

by TOM MOFFAT, VK7TM

Most radio and electronics enthusiasts have owned at least one shortwave or communications receiver, and many 'trade up' when a new model comes along, just like with cars. I've owned a pile of them, starting with a Hallicrafters S-38B when I was a kid. This was the most popular radio in the land back then, but it would be laughed at as totally inadequate today. Or more likely, seen as a classic.

I've been through at least a dozen HF receivers since then, some excellent and some absolutely horrible. I've got three at the moment: an Icom 735 amateur transceiver with general coverage receive, a little Sony ICF-SW7600, and an Icom R-71A which is destined to become a classic in its own right.

As well I've reviewed lots of other receivers, from some lovely models from the Japan Radio Company, right up through the 'Rolls Royce' of them all: the Icom IC-R9000.

Why bother with shortwave in the first place? Isn't there plenty to listen to on the local AM and FM broadcast stations? Well, over three days of listening while preparing this article, I discovered the following:

Joe Adamov was an official spokesman for the USSR government. Now, with the new Commonwealth of Independent States, he is heard on Radio Moscow making impassioned speeches *against* communism.

Radio Moscow has a signature tune called *Moscow Nights*, played by a big band in the key of F minor — which made it damn hard to copy on the accordion. But it's now been taped, transposed, and used regularly by the Burglar's Dog band of which I am a member. Thank you, Radio Moscow!

Speaking of accordions, there is a polka band in America called Brave Combo that plays rock music. They *must* be brave! From Voice of America.

Still on accordions, virtuoso Flaco Jimenez said on Radio Spain that his grandfather invented Tex-Mex music in San Antonio, Texas. That's news to me; I was taught it developed in Mexico following the Austrian invasion. Is Flaco having us on?

Still on Mexico, a Mexican cardinal was accidentally killed during a gun battle between drug lords. This was widely reported on international shortwave news services, but virtually ignored within Australia.

Compact disks are as expensive in England as they are in Australia. There is to be a parliamentary inquiry in England. From German radio, Deutsche Welle.

Politically correct language — like 'spokesperson', 'chair' — only seems to emanate from Australia and New Zealand. Elsewhere, such as the USA, Russia, and Britain, 'spokesman' rules. Also, we appear to be the only ones to say 'hectopascals'. Everywhere else, it's 'millibars'.

Aha! Instant broadening of the mind, courtesy of the shortwave receiver...

Manual vs 'auto'

Let us look at the current state of play, staying with the 'cars' analogy. Most of the latest receiver models have automatic transmissions and sophisticated microprocessors under their bonnets. You just step on the pedal and they go, with the least amount of effort. Most of the 'smarts', to do with things like appropriate bandwidth and tuning rates, are taken care of by the micro.

The previous generation of receivers were controlled by microprocessors as well, but they also had manual transmissions so the driver could make more of the choices. These radios had heaps of knobs, most of which were seldom used. In the hands of the average user, these receivers were inferior to the later 'auto' models, because they were driven around in first gear all the time. Only really dedicated people drove them to perfection, working through the four or five gears, selecting the best performance for every hill and valley.

The latest receivers with all their automation are very, very good. You turn the tuning knob and the stations jump out and sit on your lap. But with the 'manual' receivers, you can tailor every part of the system to match each signal you are trying to receive — optimising bandwidth, removing interference, controlling fading and suppressing noise.

With correct twiddling of the knobs you can make your receiver sit right up and bark. Much of the theory of this, particularly concerning dynamic range and bandwidth, was covered in detail last time. Now we'll look at the practical use of the controls, and owners of the latest automatic receivers will understand just what it is that the micro is doing to pull the best performance out of a signal.

You will hear several receivers mentioned, and others ignored. This is *not* because some are good and others are bad, but because some are simply more easily available where I live in Tas-

Yaesu's new FRG-100, a compact and attractively priced 'automatic' type communications receiver.

mania. Yaesu and Icom are both actively marketed here; Kenwood and JRC are not. But the principles of all makes are much the same.

Gain controls

We spent a lot of time on gain last time, within the context of dynamic range. Too much gain and strong signals break apart into noise and distortion; too little gain and weak signals get lost. To correctly receive any signal, gain has to be *just right*.

Receivers with 'manual transmissions', such as the Icom R-71A, usually have an RF GAIN control, as well as the ability to turn the RF stage completely off — and for very strong signals, replace it with an attenuator. Automatic receivers are usually limited to the attenuator, with the rest of the gain functions being handled by the microprocessor.

When you are tuning around with an automatic receiver, the S-meter, which is an indication of automatic gain control action, might be reading near the bottom. Little AGC is being applied, gain is quite high, and you will hear the familiar hiss and crackle of 'radio noise'. If you disconnect the antenna, the crackle will disappear, and often the hiss will increase to sound like steam escaping.

However the noise floor in the Icom R71-A is so low that without an antenna it goes virtually silent. Sometimes I've disconnected the antenna from the R-71A, to use it for something else. Then when I've turned on the receiver I've gotten a big fright, thinking the thing has gone dead.

With a manual receiver YOU can decide how much gain is to be used, and how it is to be applied. The decision will be dependent on your assessment of how much noise is present, how 'hot' the band is, how strong or weak is the signal you want to receive, and the type of signal.

You can take *total* control of the receiver's gain if you select MANUAL gain control. But usually the first line of defence is to leave the AGC alone and adjust the attenuator and/or RF amplifier switches, for prevailing conditions. This also applies to automatic receivers, where the AGC is always used.

For 'average' conditions, my preference is to leave the RF amplifier disabled. In many receivers, this allows the antenna to be fed straight into the first mixer, a situation which produces the best dynamic range. If I tune around and notice everything is pretty weak, I'll judge receiving conditions to be 'dead' and *then* I'll cut in the RF amplifier. This is most likely to be necessary on the higher frequencies. Since all of these signals are weak, there is little likelihood of any of them 'hitting the ceiling' by exceeding the receiver's dynamic range.

There are times, particularly at night on the international shortwave broadcasting frequencies, when the bands sound as 'hot as a firecracker'. Even when you're not tuned to a particular station, the S-meter will be reading around S-5 and there will be a constant 'burbling' coming from the speaker. A moderate amount of AGC will be in effect, so there won't be noise as such, just a burbling as if a thousand people were muttering to themselves. I have to admit I wouldn't have any idea what causes this sound; maybe it's just lots of weak stations.

With the band jumping like this, some stations will produce enormous signal strengths, and there is a chance that one or more may exceed the ceiling of the receiver, causing overload. So here is where you use the attenuator.

Some really flash receivers give you a choice of attenuators. Choose the setting that lets the S-meter fall to zero between stations. The receiver will then be much more tame, strong stations will be more manageable, and weaker signals will be easier to tune.

RF gain control

In receivers of the past, the RF gain control affected the RF stage only, but in modern sets it's usually applied to the whole kaboodle — RF, IF, and sometimes even the mixers. Old-time Morse Code operators were taught to turn the AF gain (volume) all the way up and then control the volume in their headphones with the RF gain control. The idea was to suppress the noise between dots and dashes, producing a perfectly clean and noise-free signal. This technique still works well today in receivers with manual gain control, although it would be unwise to turn the volume all the way up. Today's sets can easily

Shortwave Receivers - 2

generate enough audio power to burst an eardrum.

The RF gain control can be used to advantage for single sideband too, where there is noise or weak interference. Here AGC tends to pull the noise up between words, and even more so if the person speaking pauses to gather his thoughts.

A slow-speed AGC is sometimes provided to combat this, but even then the noise will come up between sentences. If conditions are good, you can use manual gain and turn it down so that the desired signal is nice and strong, but the spaces between words are totally silent. Reception is so easy and it's just like talking on the telephone.

The time NOT to use manual RF gain is when listening to an AM signal. With manual gain the signal will go soft and loud, soft and loud, and drive you mad. With AGC the receiver is constantly measuring the strength of the carrier and adjusting the gain to keep it as constant as possible.

Many receivers let the RF gain control influence things, even when the gain is supposed to be automatic. Icom has arranged theirs so that when AGC is being used, the RF gain control acts as sort of a threshold control, below which all signals and noises are masked. As you increase the RF gain control the S-meter starts to climb, even when there is no signal.

The level shown on the S-meter is that below which everything is silenced. Signals above the magic level are affected by the AGC in the usual way, and the S-meter moves up and down to reflect this. When conditions are good the masking level can be set so there is absolute silence between signals as you tune the band.

Noise blanker

This is another gadget to turn useless signals into something you can listen to. The idea, of course, is to remove noise, leaving only the signal. However noise comes in many forms, and a noise blanker can only attack noise with certain characteristics — the noise must consist of sharp spikes, and it must be repetitive.

A noise blanker will NOT work on hiss, static crashes, or noise from power lines. It *will* help with ignition noise, which consists of repetitive pop-pop-pops. It will also help with purposely transmitted over-the-horizon radar pulses, which sound like a jackhammer sweeping across the spectrum.

The simplest kind of noise blanker is nothing more than a pair of diodes that can be inserted in the signal path to 'clip' any signal larger than their conduction point. Sometimes a variable 'clipping level' control is provided to select the signal strength at which clipping occurs. In this case it is assumed that the noise pulses will be bigger than the desired signal. The clipper simply chops them down to the same size. Setting the clipping level any lower attacks the signal too, causing distortion.

A more sophisticated technique detects the noise pulses and then mutes the whole receiver for the duration of the pulse. This leaves the signal full of tiny 'holes', but they are so brief that they are almost unnoticeable. A really snazzy circuit will take note of the time between the pulses — that's why they must be repetitive — and shut down the receiver just BEFORE each one arrives. Some receivers let you select the length of time the receiver is blanked; short blanks for little pops like ignition noise, and long blanks for radar pulses.

Noise blankers range from amazingly fantastic to totally useless. If you are thinking of buying a receiver you should make an attempt to try its noise blanker on air, or at least read a review by someone else who has done so. Regardless of the design and quality of a noise blanker, it should NEVER be left on if you don't need it, because it could make a mess of the receiver's dynamic range.

I once spent several hours on a yacht trying to get a weatherfax machine to work. Its pictures were nothing but black smears, and the radio's audio sounded awful. The problem turned out to be the radio's noise blanker, which the owner left on all the time in the hope that it would 'improve' every signal. When we flipped it off, the weatherfax instantly came good. And when we tuned to the next weather broadcast on SSB, the owner was thrilled to find the radio was actually understandable! Ever since he'd installed the radio, the fellow had been hearing nothing but signals with 50% or so distortion...

Keeping in tune

Old receivers used a 'free-running oscillator' as the first local oscillator that selected the frequency to be received. Designing an oscillator that would stay on frequency was a real art involving heavy enclosures, careful voltage regulation, and temperature compensation.

Even then some were pretty slack. I once had a receiver that I could tune 2kHz higher by just blowing on it, and if you picked it up and twisted the case it would vary over 5kHz or so.

Nowadays things are much better. Oscillators are synthesised, with their accuracy dependent on a fixed crystal oscillator. A good modern receiver can tune 'bang-on' to a signal by just keying in its assigned frequency on a keypad, or stepping through the kHz with a tuning knob. The tuning steps are usually selectable, with something like 1kHz steps for moving quickly through the spectrum, and 100 or 10Hz steps for fine tuning.

On manual radios you must usually press a button to select a tuning step. Many automatic radios select the step for you, depending on how fast you're turning the knob. If you give it a good spin the microprocessor will select the 1kHz rate, but when you slow down to zero in on a station, the micro will go back to the smaller steps.

How accurate the tuning is, of course, depends upon the 'master' crystal oscillator. Some receiver manufacturers offer the option of a super-accurate (and ex-

The Icom IC-R71A receiver has been around for a while, but is widely regarded as a excellent performer for the experienced user who wants a lot of 'manual' control over receiver functions.

pensive) master oscillator, instead of the normal one. From experience my advice to you would be to save your money. Even the stock-standard master oscillators are so good that you will always land within 20 or 30Hz of the desired frequency.

Of course the master oscillator has to be calibrated against something even better, if it is to be accurate. This is done before the radio leaves the factory, but many times you can improve on it, and after a couple of years' use it's also wise to check the calibration. The standard to use is one of the time and frequency stations such as WWV in the USA or VNG in Australia.

The technique is simple. Every receiver has a 'tweak' adjustment of some kind to calibrate the master oscillator. Sometimes you have to open the case; in other designs there may be a screwdriver hole on the back. Once you've found the tweaker (try the instruction manual), tune the receiver to one of the frequency-standard stations, say WWV on 10MHz. Although this is an AM station, set the receiver for upper or lower sideband reception and set its frequency for exactly 10000.00kHz on the dial.

The station will probably sound like slightly off-tune SSB, accompanied by a low-pitch tone. The tone is the 'beat note' between the oscillator in your receiver and the carrier of WWV. The tone's frequency is an EXACT measure of your receiver's tuning error. The idea is to get the tone frequency to zero.

You can now use the screwdriver adjuster to correct the tuning so that it is spot-on. As you approach perfection the tone frequency will drop and eventually become inaudible. Now watch the S-meter, and as you get closer to WWV it should begin to tremble, first fast and then slower and slower.

Soon you will get to a point where the S-meter moves only very slowly, and then not at all. This is a real hair-line adjustment, and is known as 'zero beat'. Your receiver should now be in perfect calibration.

A quicker but slightly less accurate method involves listening to the 'pips' transmitted by the station. First listen to the pips on AM, and then switch to SSB. Adjust the tweaker so that the audio pitch of the pips on SSB is the same as on AM. Try both sidebands, and if there is a slight difference between them, set the pitch for an average.

Notch filter

This feature, usually found only on manual receivers, is another weapon against interference. A second signal may pop up, on top of the one you're trying to listen to. If this is a narrow band signal such as teletype, Morse Code or just an unmodulated carrier, you may be able to remove it with the notch filter.

The notch filter can be adjusted somewhere within the receiver's IF, to remove a narrow slice (notch) of spectrum while leaving the rest undisturbed. You simply adjust the knob until the interfering signal is attenuated as far as possible. The rest of the desired signal, both above and below the notch, comes through unaffected.

Notch filters are like noise blankers; some are great and some are useless. A good test of a notch filter is to tune in an AM signal in the normal way and then try to remove the station's carrier with the notch filter. If you are successful the audio will suddenly sound absolutely awful, as the receiver attempts to demodulate an AM signal which has no carrier.

You can judge the narrowness of the notch (the narrower the better) by how rapidly the signal goes kerflooey as you approach the carrier with the notch. With a really good filter there should be only the smallest rotation of the knob where the carrier is eliminated; in other positions the signal should remain intact.

AM tricks

In the first article we made a detailed study of how different IF filters are used to receive various kinds of signals. From a practical point of view, you can almost always simply hit the AM button and listen to what takes your fancy. I am very lazy; if a signal is too scruffy I'll usually pass it by and look for something easier. International broadcasters realise this; that's why they run enormous powers to try to make their signals as easy to receive as possible.

However there are times, especially if you're a keen DX-er, when you will want to 'dig' for a signal. One quick and easy way, especially with an automatic receiver without passband tuning, is to receive the AM signal as SSB.

Here the procedure is exactly as in the frequency calibration technique mentioned above: you tune the receiver until its beat oscillator is on exactly the same frequency as the desired station. If your receiver is stable and its frequency doesn't drift, you can listen for hours this way. Less stable receivers may need the occasional correction.

Some receivers, such as those made by the Japan Radio Company (JRC), offer this kind of reception as a proper 'mode'. They arrange for their beat oscillator to lock itself to the incoming carrier. Sometimes a wide filter can be used as well, producing good wide audio from a signal that may be under intense attack from a nearby station.

Real world sets

What receiver should I buy? I get calls and letters all the time, asking this very question. Armed with information from this article and the first, you should now be able to decide what kind of listening you want to do (AM, SSB, digital modes?) and what features are needed to best bring it off. So here are a few suggestions, beginning with the receivers I own at the moment.

First, the receiver part of the **Icom-735** amateur transceiver. If you do not have an amateur licence to transmit, you're wasting your money on something like this, even though its receiver portion is excellent. But should you be considering going after a licence in the future, it might be worth grabbing a transceiver now. The 735 receiver is of the manual variety. There is an RF gain control and you can shift the filter all over the place. AM sounds excellent on music, provid-

Although it offers many of the same functions as Icom's IC-R71, the newer IC-R72 model shown here is more 'automatic' in operation and intended for those who prefer a simpler user interface.

ing you use an external speaker. The 735 is a reliable performer on digital modes.

Just about every HF amateur transceiver made today has a 'general coverage' shortwave receiving capability. The up-market rigs are usually built to 'competition standard', for serious hams who revel in working the most difficult signals. So their receivers are quite astounding.

Next, the **Icom R-71A**. This radio has been used as an example throughout this series, and the graphs last month will show the excellence of its design. However it's got a few irritating quirks, such as the way its frequency must be readjusted each time you change modes. Also it's only got 32 memories, which is a bit light-on nowadays.

Where the R-71A really shines is in the digital modes: radioteletype, fax, and Morse code. It has absolute stability and will sit on a fax or RTTY station all day long delivering faultless copy. The receiver lives on my workbench and it's been the main signal source for all the fax, RTTY, and Morse decoders I've designed in the past few years.

For shortwave listening on the AM bands, the R-71A might not be the best choice. Technically it's very good and it can dig poor signals out of bad interference, but its audio quality isn't the best and it's not really pleasant to listen to over a long period.

I once owned a **Yaesu FRG-8800**; this had the best quality recovered audio of any receiver I've used. However for digital modes it's slightly inferior, because of some minor frequency drift.

Both the R-71A and the FRG-8800 are obsolete models, having had a successful run of close to 10 years. Their longevity shows just how good they are. The R-71A will continue to be available to special order, and the last time I looked there was still an FRG-8800 for sale in the Hobart Dick Smith Electronics store.

The R-71A has been supplanted by **Icom's R-72**, which is a fully automatic receiver. You don't have the choices of gains and filters, but for all except the most demanding uses you can just turn it on, tune it in, and forget it. The R-72 sounds great on AM and SSB and it's also a good performer on digital modes.

Yaesu's FRG-8800 has been replaced by the new **FRG-100**, reviewed by Jim Rowe in the July 1993 issue of *EA*. Like the R-72 it is fully automatic. I haven't actually seen an FRG-100, but Jim seems to have been pretty impressed with it. You might want to have a quick look back at his review.

The FRG-100 is the latest in a long line of 'FRoGs' from Yaesu. All have been successful in the marketplace and are much admired by experienced users of receivers. The very first Frog — the FRG-7 — still appears on the used market from time to time.

This is a manual receiver with no microprocessor, so the operator is in total control all the time. Expect to pay

Sony's ICF-SW7600 is very compact and portable, but provides a surprising array of facilities and reception modes.

around $250 for a used FRG-7. It is an ideal first receiver. A similar radio from the same era, which I once owned, is the **Drake SSR-1**. This was not quite as good as the Frog, but if you can pick up a used one for $100 or so it's a good place to start.

Back to modern receivers, the baby of them all would probably be the **Sony ICF-SW7600**. This pocket-sized package has keypad-entry tuning from 0.1 to 30MHz as well as 76-108MHz FM stereo. With its whip antenna it is pretty deaf on shortwave, but given a decent antenna the Sony is a remarkable performer. It is the hottest of the bunch on the LF band if you like snooping around the aviation beacons, and it receives interstate medium-wave broadcast stations during the daytime using its internal antenna.

The SW7600 has tuning steps of 5kHz — pretty big — and it uses a variable knob to fine-tune between the steps. The receiver has a BFO so it can receive SSB and the digital modes. It comes with a nice protective case and is about the size of a paperback book.

I bought a SW7600 to use as part of a handheld weatherfax system I'm working on for a Hewlett Packard palmtop computer. It works nicely in this role, but I find I'm using it more and more to cruise around the shortwave bands, just because it's so easy to use. All of those 'news items' at the beginning of this article were collected with the 7600.

Retail price of the SW7600 is $399, so it's starting to look like it would make a good first receiver if you can pay a little more than for a used Frog. The 7600 first appeared around the time of the FRG-8800 and the R-71A. On the outside it's stayed pretty much

After a break of a few years the R.L. Drake Company has re-entered the market with two impressive new models. This is the lower cost SW8 receiver, designed for the shortwave enthusiast.

the same, although the colour has changed from silver to black. But inside the radio has evolved to the stage where most of it is made of surface-mounted components. I wasn't real impressed with the earlier version of the 7600, but this latest one is tops.

The worst receiver I've owned was a **Bearcat DX-1000**. This monster had a lofty internal noise level, combined with a propensity to overload at the drop of a hat. It didn't really need an AM broadcast band capability as you could hear all the local AM stations spread throughout the shortwave bands.

The DX-1000 was the textbook illustration of an absolutely awful dynamic range. I only had mine for a short time before I got rid of it and bought a FRG-8800. I forget who I sold it to, which is probably a good thing.

Tom's antenna tips

I think it's fair to say that with a shortwave receiver the antenna is everything. More important than the dynamic range, or the filters, or all the knobs and switches — a decent antenna will make your radio shine. A lousy antenna on a high-quality receiver is like putting a set of crummy tyres on a Ferrari; it will be noisy and have a mushy ride.

As far as I am concerned there is only ONE suitable antenna: a *balanced* dipole connected to a *balanced* feedline. Forget your coax-fed antenna, and forget your long wire; this is the worst choice of all. Balanced, *balanced*, BALANCED — stand on your tiptoes and shout it out, then write it on the blackboard a thousand times!

If your antenna is balanced, it will receive signals coming in from afar, but it will firmly REJECT stuff from nearby; in particular, noise from the mains power system. To be balanced the antenna must be absolutely symmetrical. The feedline must be connected exactly in the centre. The balanced feedline can be el-cheapo TV twinlead, or even speaker wire. For receiving, anything is fine providing it has two conductors which run parallel to each other.

Once near your receiver, you can use up to a metre of coax — but NO MORE! And you MUST use a 'balun' transformer for the BALanced to UNbalanced transition between the feedline and the coax. A suitable balun design appeared in *EA* for May 1991. Please note that the balun cores offered in that article have long gone.

As for the antenna itself, it should in theory be half a wavelength long at the frequency of interest. But we are interested in all frequencies, so the correct length of the antenna is probably whatever you can fit onto your block of land. It's not really important. I use a dipole cut for the 80-metre amateur band (3.5MHz) and it works fine from 100kHz to 30MHz. Just make sure, whatever the length, that the feedline is connected in the *centre* so the antenna is BALANCED!

Just to prove to yourself the value of a balanced antenna, temporarily disconnect one of the wires going into the balun. The other wire will still receive well, and on frequencies below that for which the antenna is cut, signal strength may even increase. But power line noise will increase even more, making listening very unpleasant indeed. Reconnect the second wire and golden silence will return, with only incoming signals being heard.

A final tip: the new compact fluorescent lights generate heaps of radio noise. If any are in use in your house, even in a different room, they could destroy any hopes of decent shortwave, medium wave, or long wave reception. I have found it necessary to replace them with old-style incandescents, when I go hunting weak signals at night. ❖

Product review:

Mini subwoofer system from Jaycar

Designed to enhance the low bass response of smaller loudspeaker systems, this compact subwoofer features a separate driver and crossover network for each stereo channel, and simply connects 'in-line' with the existing speaker wiring.

by ROB EVANS

Judging by the popularity of subwoofer projects presented in *Electronics Australia* over the past few years, and the large number of commercial speaker systems now based on this concept, it seems that these dedicated low frequency speakers are here to stay. The appeal of a subwoofer-based system is largely due to its very compact size when compared to a conventional setup, and the way in which an existing speaker system can be upgraded at a minimal cost, just by adding a subwoofer — in the past, the only real alternative was to purchase a larger set of speakers to gain an improvement in bass response.

To ensure that the subwoofer only handles the very low frequency part of the audio spectrum though, some kind of low-pass filtering must be used. This usually takes the form of a passive crossover filter housed within the subwoofer itself, or an external active filter that feeds a dedicated subwoofer amplifier. As it happens, most larger subwoofers, plus those presented in past issues of *EA*, are intended for *active* driving circuitry and don't include an internal crossover filter.

While this type of system is very flexible for adjusting the subwoofer's output and provides a substantial increase in the overall system's power output (thanks to the additional amplifier), it tends to be a more complicated and expensive approach. A subwoofer equipped with a *passive* crossover on the other hand, does not incur the cost penalty of an additional amplifier, and is very simple to setup — it's driven directly from the existing amplifier, like any other part of a multi-way speaker system that uses a passive crossover.

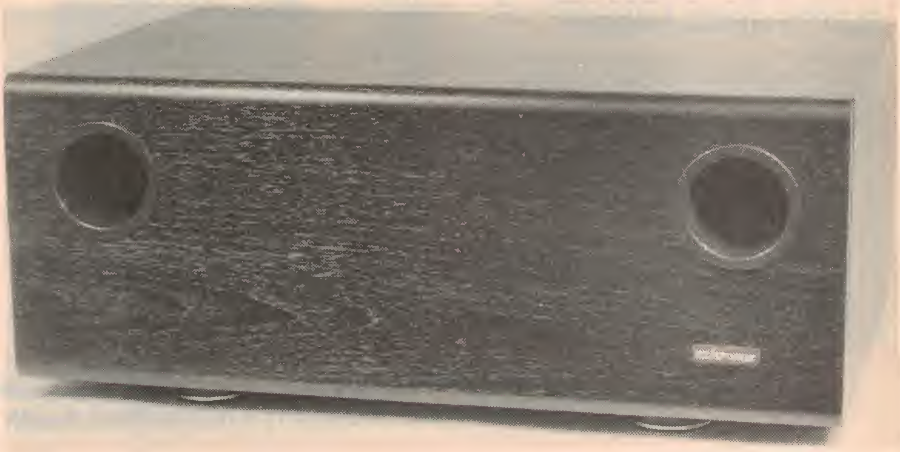
As you've probably gathered, this is the approach taken with Jaycar's 'RE/SPONSE' subwoofer shown here. It contains a first-order (6dB per octave) two-way crossover for each stereo channel, where the low-pass section directly feeds the subwoofer's speaker and the high pass output is wired to speaker connecting terminals on the unit's rear panel. This recessed panel contains four pairs (+ve and -ve) of connectors in all, with two for the speaker leads from the stereo amplifier which is driving the system (the input, in effect), and the remaining two for the pair of speakers handling the higher frequencies (i.e., each crossover's high-pass output).

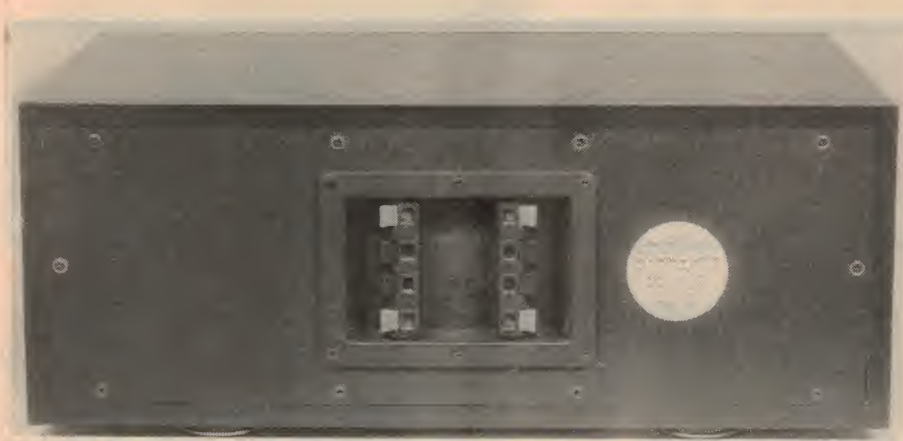
So with this setup, all that's needed to add the RE/SPONSE subwoofer to an existing stereo system is an additional pair of speaker leads, so that the unit can be connected between the amplifier and the main speakers — you could even cut the existing speaker leads, and 'insert' the subwoofer at that point. And note that since the unit contains a driver for each stereo channel, you only need one RE/SPONSE subwoofer to enhance a system's bass response.

All in all then, this type of passive subwoofer system is quite a neat arrangement, and is very easy to add to an existing stereo system. In theory however, the disadvantage of this type of subwoofer stems from its very simplicity, since both the crossover frequency and its output level are quite fixed — which in turn means that you cannot 'tune' the system for an optimal match between the low and high frequency loudspeaker characteristics. Note that with an active subwoofer system, it's quite an easy matter to vary both the output level and crossover frequency of the active filter which is driving the subwoofer's power amp, so that there is a smooth and even changeover between the low and high speaker systems.

Regardless of what crossover and driving system is used with a subwoofer though, its ability to handle the low frequency energy will largely depend on the enclosure design, and how well this suits the drivers used in the unit. In the case of the RE/SPONSE subwoofer the designers have elected to use the increasingly popular 'bandpass' type of enclosure, which employs two cabinet volumes that are tuned to different frequencies.

This type of design has been used in past *EA* subwoofer projects, and has





Thanks to its internal two-way crossover network, the subwoofer simple connects in-line with your normal speaker leads. The rear terminal plate has input connections for a stereo amp, and outputs for a set of main speakers.

proved to be very effective for subwoofer applications. The bandpass enclosure offers a natural high frequency rolloff, a very 'clean' output signal, relatively compact dimensions, and a high output level capacity.

With the RE/SPONSE subwoofer, its bandpass enclosure has quite modest dimensions of 437mm x 180mm x 300mm, and radiates sound via two 50mm ports that 'fire' through the unit's front panel. The enclosure appears to be constructed from the usual high-density particle board sporting a black finish, and is supported by four turned aluminium feet. All in all, it's quite a neat little unit that should be able to hide discreetly under a range of typical lounge room furniture.

By the way, the drivers used in the enclosure appear to have nominal diameter of 130mm (5"), use a pressed metal basket, and carry quite a generous magnet assembly. And according to Jaycar's literature, the unit itself has a nominal power rating of 50W RMS, which should be quite suitable for most smaller hifi systems.

Tests

Due to its passive style of connection, it's a little hard to tell just how successful the RE/SPONSE subwoofer might be when coupled to a range of small hifi systems. In an attempt to ascertain this, we performed a number of objective and subjective tests with three different speaker systems, which were all in typical domestic locations.

To put it simply, we had a 'two out of three' success rate for the subwoofer's compatibility with our test speaker systems. In two of the cases, the RE/SPONSE unit was of a comparable sensitivity to the main speakers and the crossover frequency seemed appropriate, which led to a pleasing improvement in the system's overall low bass response. The setup could handle quite high volume levels with surprising ease, and while the low bass did not really extend into the 'gut rumbling' area, the improvement was clearly worthwhile.

The one test that wasn't so successful involved a set of bookshelf speakers that appeared to be rather more sensitive than the other two, and consequently, tended to dominate the level produced by the RE/SPONSE subwoofer. To compound the issue, they also seemed to have a phase response that was at odds with the subwoofer around the crossover frequency, thereby causing a deep hole in the response at this point.

While the incompatibility between the subwoofer and that particular set of speakers may well have been a rare and unfortunate combination, the end result was that *this* system clearly performed better *without* the subwoofer connected. We should add though, that the bookshelf speakers in question are several years old, and more recent designs tend to have a lower sensitivity and more linear phase response — which implies that they should be far more compatible with the RE/SPONSE subwoofer. Clearly though, there's an element of chance involved...

On the more objective side of things, we performed a range of tests on the subwoofer using our new IMP speaker testing system. This showed that the unit has a usable acoustic output in the range of 40Hz to 250Hz, and exhibited significant peaks in the response at around 80Hz and 200Hz.

In our experience, this type of double-hump response is an inherent characteristic of bandpass enclosures that have been 'tuned' to a relatively high Q figure, and probably reflects the designer's efforts to extract the highest possible acoustic output from the unit. We would be inclined to sacrifice a little sensitivity for an improvement in the output linearity, by moving the enclosure's bottom tuning point to a slightly lower frequency. But on the other hand, the resulting drop in sensitivity would reduce the subwoofer's effectiveness with more efficient speakers...

We also performed a few quick tests to determine the unit's internal crossover characteristics, since this ultimately handles all of the speakers in the system, once the subwoofer has been installed. The plots from our IMP testing system indicated that the crossover's high-pass outputs have a rolloff point of around 200Hz when the main speakers are 8-ohm units, and about 300Hz for 4-ohm speakers. The crossover's low-pass output, which directly feeds the subwoofer speakers, appears to roll off at around 800Hz.

The high-pass crossover point seems suitably matched to the subwoofer's natural high-frequency rolloff of around 250Hz, and should suit most setups. While it may seem a little curious that the low-pass filter rolls off at a much higher frequency (800Hz), we suspect that its main function is to attenuate the energy produced by reflections within the enclosure — these are a natural artefact of bandpass designs, and are harmonically related to the main 'bandpass' output.

Both crossover outputs have a 6dB/octave slope as expected, and the circuit uses a bipolar electrolytic capacitor for the high-pass output and a ferrite-cored inductor for the low-pass output. An air-cored inductor would be preferable for this latter output, but for the modest power levels involved there may be little apparent improvement — and of course, thanks to the large amount of copper wire needed for an equivalent air-cored unit, the cost would be far higher with this approach.

Since the RE/SPONSE subwoofer is reportedly a *4-ohm* unit, we were a little concerned that its input impedance may fall significantly below four ohms when a set of main speakers are connected — as this may upset the amplifier used to drive the whole setup. By performing a number of impedance plots with a range of speakers wired to the subwoofer, we found that this was indeed the case — although not seriously so.

While the very low frequency (or DC) impedance was around four ohms as expected, the impedance dipped to 3.5 ohms at 220Hz with a typical set of 8-ohm speakers connected, and 3.7 ohms

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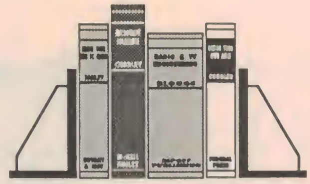
NEW BOOKS



Satellite directory

94/95 ASIA/PACIFIC SATELLITE BUSINESS DIRECTORY. Published by MLE Inc, 1994. Soft cover, 279 x 215mm, 352 pages. ISBN 0-929548-13-2. RRP $99 plus $8 express post.

As Australia finally moves into the satellite TV era, books on the subject are becoming both relevant and available. This new release is an update on the latest developments in our area of the world, from the same people who produce the World Satellite Almanac.

After an initial chapter reviewing events in the 12 months ending last December, it has a further nine chapters devoted to topics such as the disputes for regional orbit 'slots', Intelsat developments in this region, Asiasat and Apstar, other systems including Palapa, ARABSAT, Tongasat, Rimsat and Unicom, the PanAmSat global satellite system, the Columbia and PacifiCom regional satellite systems, and MPEG-2 digital compression technology as being used on the new Thaicom-1 and DBS-1 systems. These chapters take the first 150 pages, with the second half of the book essentially a true directory of satellite TV and radio services in this region — first indexed by orbit location (chapter 11), and then by country (chapter 12). A final 'yellow pages' section of about 30 pages gives full names and address/phone/fax numbers for a large number of product and service providers in this region.

In short, it's a timely and very handy reference for anyone who is, or is planning to be active in this technology.

The review copy came from Australian distributor Peter C. Lacey Services, of 80 Dandenong Road, Frankston 3199; phone (03) 783 2388. This firm can provide copies for the price shown. (J.R.)

Circuit analysis

PC-ASSISTED LINEAR CIRCUIT ANALYSIS AND DRAWING, by Ian Sinclair. Published by Butterworth-Heinemann, 1993. Soft cover, 190 x 245mm, 279 pages. ISBN 0-7506 1662 8. RRP $49.95.

This book is aimed at technicians, interested amateurs and anyone involved with linear circuit development. It discusses two separate but somewhat related topics: using a PC as an aid in circuit analysis, and for circuit drawing.

The circuit analysis program is called Aciran, of UK origin. Aciran is a shareware program, priced at UK£50. It may not be generally available in Australia, but author Sinclair thinks it's excellent.

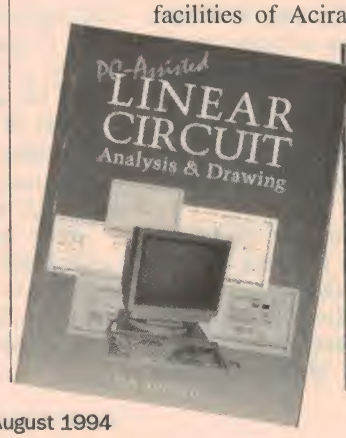
The circuit drawing package described is AutoSketch, a derivative of the well known AutoCad. In effect, the last three of the book's 10 chapters is a description of how to use AutoSketch. However, unlike the AutoSketch manual, the book concerns itself only with *circuit* drawing.

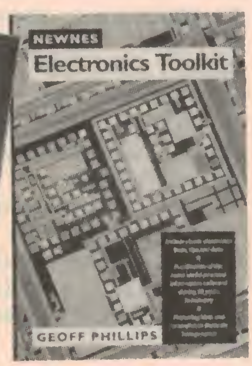
Chapters one to six explain some computer fundamentals, and how to use Aciran. The book also explains how to install Aciran and how to set it up, on the assumption that the reader knows more about electronics than computers. There are many examples on using the program, including some where the effects of stray capacitance and load resistance are considered.

As you read the text, you learn as much about electronics as you do about the facilities of Aciran. The circuits being analysed include simple RC networks, op-amp filter circuits, LC resonant circuits and transistor amplifiers. ORCAD users are catered for, as there is a conversion utility supplied with Aciran to accept ORCAD files; but I could find no mention of Protel Schematic.

The writing style is friendly without being patronising, and there are many illustrations. The book has good reference material, but is especially useful if you have Aciran or AutoSketch.

The review copy came from Butterworth-Heinemann, PO Box 345, North Ryde 2113. It should be available from technical and larger bookshops. (P.P.)





Handy reference

NEWNES ELECTRONICS TOOLKIT, by Geoff Phillips. Published by Butterworth-Heinemann, 1993. Soft cover, 155 x 234mm, 158 pages. ISBN 0-7506 0929 X. RRP $39.95.

There are two kinds of electronics reference books: those that attempt to summarise everything and those that only present the *important* facts. But who decides what's important? In most cases the author does, so with a book of this type the first thing I want to know is about the author. According to the back cover copy, Geoff Phillips has had 30 years experience in industry. And looking through the book I have to agree that the information he presents is indeed typical of what I would like to have on hand.

There are 10 chapters, one each covering resistors, capacitors, inductors, semiconductors, circuit concepts, electromagnetics, sound, light, heat and connections. As you would expect, there are many tables, and quite a lot of circuit diagrams. Virtually all the essential and basic electrical/electronic formulae are included, and the author gives a list of his 'Rules of Thumb' for each topic.

A very useful thing to have on hand is summarised data about ICs and discrete components. Many readers probably use the DSE catalog for this purpose, and this book presents similar data. However it also gives a pinout diagram beside the device.

The largest chapter is on semiconduc-

(Continued on page 46)

Projecting essential flight data onto glass within the cockpit, this "Head Up Display" enables F/A-18 pilots to keep their eyes in the sky. This is typical of the leading edge technology the Air Force is involved in.

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When I Think Back...

by Neville Williams

Howard Kingsley Love: From pioneer VK3 amateur to equipment manufacturer - 2

Having done much to promote amateur radio in the 1920's, Howard Love set up his own factory in the 30's and made a significant contribution to the war effort in the 40's, by way of communications and radar equipment. Behind the scenes was an on-going interest in the application of ferrite particles to radio frequency circuits — leading ultimately to the Kingsley 'Ferroclad' and 'Ferrotune' technology.

The development of the KCR11/AR7 communications receiver was described last month. The demand for this receiver went well beyond the RAAF, which had initiated the project. KCR-11's were also supplied to other units of the armed forces and to the Australian Civil Aviation Department.

A special version for the Army, designated 'Aust Reception Set No.1' had an engraved brass panel with a black background to minimise reflections. The receiver and its coil drawers were fitted into a typical khaki Army carrying case, with a separate matching case for the power supply.

Another special version for the Dutch Navy required a front panel lettered in their own language. Altogether, some 3200 AR7 type receivers were supplied, posing a major problem for Kingsley to secure the requisite materials and components for their construction.

George Neilson recalls that HK's former secretary Mollie Malone was entrusted with chasing up supplies. She did a splendid job but, for her, it climaxed once the materials and components for a specified number of receivers were safely on the shelves. While she obviously knew they were there to be used, she seemed almost to resent it when assemblers fronted up for another kit of parts: "I hope you realise how difficult it was to get these parts!"

Thinking back over the AR7 era, George Neilson said that Les Eastwood and Ivan Harvey joined the staff as sheet metal professionals, while Charles Mutton and Jack Kling, well known in the Melbourne radio industry, released John Bremner by taking over AR7 testing and adjustment. Ken Boole of the Aeronautical Inspection Directorate did much to keep the supply lines moving, while Tom Heywood and his mate Laurie Buckingham "were the core of the wiring line", later moving into the Design Lab.

In his book Australian Radio, the Technical Story 1923-83, former STC Engineer Winston Muscio discusses Australian wartime communications receivers, mentioning specifically the STC A679-3, the AWA AMR-300 and the Kingsley AR7. Of these, the STC receiver used switched coils, the other two plug-in coil drawers. He says that, in terms of performance, anecdotal evidence favoured the Kingsley AR7 — but also suggested that it was less well proofed against a tropical environment.

RAAF leads the way!

One of Kingsley's contacts at RAAF Headquarters was Flight Lieut. Jack Parr, who was well known around the Melbourne radio trade, prewar, from his component manufacturing business in Chapel Street, Windsor.

Early in the war, he and a corporal lost their way in a truck in the Western Desert, ended up on the wrong side of Bardia, were arrested by the Italians and duly imprisoned. Some days later, the Allies overran Bardia and the Italians decided to surrender — but to whom?

Ah yes, the two prisoners!

That's how the allied invaders were amazed to see a column of about 3000 Italians marching towards them, headed up by an Italian General, an Australian corporal and Jack Parr from the RAAF!

In the post-war period, when truckloads of military radio equipment were being auctioned off to disposals dealers, I myself, along with countless other hopefuls, kept a sharp lookout for such receivers amongst the clearances; but they were apparently snapped up before reaching the bargain tables. Yet, says Winston Muscio, there was little postwar demand for Australian communications receivers at normal market prices, and production was virtually abandoned.

Unofficial consultants

While the proximity of the Military Establishment to the Kingsley factory made it easy to keep in touch — as also did the intense patriotism of HK — it made it easy for military personnel to 'drop in' from time to time to discuss their problems and bright(?) ideas.

In some cases, the problem or proposition didn't get beyond the consultation stage — but still took up engineers' valuable time. In other cases, research was involved, even getting to the prototype stage, for which it was doubtful whether the Kingsley organisation would ever get paid!

Someone from the RAAF, for example, approached Kingsley with a problem of occasional fade-out when receiving Morse Code signals. Such a problem can arise if switching on the BFO generates a spurious AGC voltage, thereby de-sensitising the receiver. To overcome this, normal practice when using the BFO is to switch off the AGC and revert to manual front-end gain control.

In this case, the so-called 'fading' was

Fig.1: In R&H for July and August 1945, Kingsley advertised 'precision Permaclad' coils and IF transformers as smaller but more efficient components for civilian replacement purposes. The advert warns that supply is subject to Kingsley's committment to defence production.

shown to be due to cyclic peaks in signal strength, causing receiver overload and 'blocking'. The elegant response to this problem was to provide a separate IF channel, to generate an AGC voltage independently of the detector, and to provide a choice of AGC time-constants to suit the circumstances.

To meet the need, Kingsley had to add an outrigger chassis to the rear of a normal AR7 to carry the extra IF channel and facilities.

In the same context, the RAAF also became involved in experiments with diversity reception, using pairs of AR7's set up a few kilometres apart, with 'phone lines linking their respective detectors and AGC systems. Assuming differential signal-fade cycles at each site, the receiver intercepting the strongest signal at any one time would supply the dominant audio signal, at the same time reducing the gain of the other receiver via the common AGC line.

Tanks very much!

But the RAAF was not alone in seeking factory cooperation, with the Army requesting assistance to adapt a Reception Set No.1 to provide a direction finding capability. George Neilson said that this involved considerable modification to the aerial input circuit, to accept the output from a D/F (Direction Finding) type antenna. The job ended up in George's lap and, to avoid disrupting normal daytime production, it was tackled on an overtime basis, giving ready access to the machine shop. He set about making six of everything, in the expectation that the Army wanted six D/F compatible receivers.

When the first receiver was ready, George and a couple of staff members took it into the Domain Gardens opposite the factory to test it in an open-air situation.

As it happened, an officer from the Victoria Barracks, heading home in a St Kilda Road tram, spied a group of civilians fiddling with something that looked suspiciously like an Army Reception set. He could hardly wait to get home to alert his peers. Very shortly afterwards, George and his mates were accosted by a group of Military Police, who were most curious to know "Wot's goin' on 'ere then?" or words to that effect.

One memorable situation arose when allied tanks in the Western Desert were being mistakenly fired on by our own planes. The Army dreamed up the idea of the planes requesting identification by means of a special transmitter. If the tank received the signal, it would supposedly release a puff of coloured smoke through its exhaust — a novel form of IFF (Identification Friend or Foe) system.

Kingsley's liaison was with a certain Captain of the Tank Corps, who telephoned one particular morning, explaining that he was to be picked up sharp at midday. A few minutes before 12, he pulled a pair of overalls over his immaculate uniform and headed for the door immediately he heard a loud rumbling in the street outside.

He was most certainly being picked up — by a Matilda tank!

Hi-Tech 'dog-boxes'

As for the smoke signal, nothing came of it — even though Kingsley Radio had been encouraged to pursue the radio link to the prototype stage! Fortunately, however, some of the consultations did prove more rewarding.

On another occasion, they became aware that Kingsley Radio was to score an upgraded machine shop. The upgrade would include a couple of new lathes — large and small — and a special shaping machine.

In its wake came a stack of drawings for what Kingsley was told was an 'RDF' unit. Only later did they realise that they had become involved in a top secret radar project.

The components concerned, which were purely mechanical, were manifestly for UHF equipment and presumably had

to do with antenna switching. Because of their kennel-like shape, they were identified in factory speak simply as 'dogboxes'.

To the technical staff, the 'dogboxes' contained what were apparently two resonant cavities, sequentially tuned by motor-driven rotating capacitor plates. A supplementary cam mechanism operated conventional automotive breaker points, presumably to provide some kind of a synchronising signal. Says George Neilson:

"It was full of beautiful brass machining and screw adjustments".

As another apparent spin-off from radar, Kingsley was advised by the Government in 1941 of a need for Australian industry to get involved in the manufacture of polystyrene. HK decided to take the hint and put a call through to an old friend, Noel Featherstone, who had at one time been involved in the manufacture of resistors at Continental Carbon. He and another industrial chemist from Sydney — George Bennett — joined the staff and set about designing a pilot chemical plant for the purpose. Unfortunately for Kingsley, Taubmans in Sydney got a head start and the project was dropped. However, other applications were in sight for the latent chemical expertise.

Postwar planning

Around 1943, the Government began to advise manufacturers engaged in defence work that they could expect Government orders to taper off and should therefore begin to plan their activities in the post-war period.

To Howard Love, it was apparent that the time had come for him to focus his attention on ferromagnetic technology, with a view to specialising in the supply of high performance IF transformers, tuning coils and integrated tuning systems. With this in mind, he made moves to add Lay Cranch to his staff, because of his technical background and his exposure to the components market through Crown Radio in Sydney. As it turned out, he also added to the staff Laurie Fitzgerald, who had been Cranch's co-designer. In fact, the stage had been set for a ferromagnetic revolution back in the early 1930's, with the adoption of an industry standard intermediate frequency of 465kHz, or thereabouts, instead of 175kHz.

As explained in this column for November 1991, an increase in the IF made it possible to do without an RF or preselector stage in urban domestic superhets. But this was with some loss in selectivity, especially noticeable when the design incorporated AVC or AGC (automatic volume or gain control).

In an effort to minimise the loss in selectivity, manufacturers sought to identify anything that might increase the 'Q' of the windings, including the use of multi-strand 'Litz' wire.

The most promising development, however, came with the realisation that a core or 'slug' containing ferromagnetic particles would allow a desired inductance to be achieved with fewer turns on the winding — therefore with proportionately reduced winding loss and higher 'Q'.

Ferromagnetic cores

By way of a bonus, it became evident that IF transformers could be tuned or 'aligned' by screwing the cores slightly in or out of the windings, thereby obviating the need for adjustable — and sometimes trouble prone — trimmer capacitors.

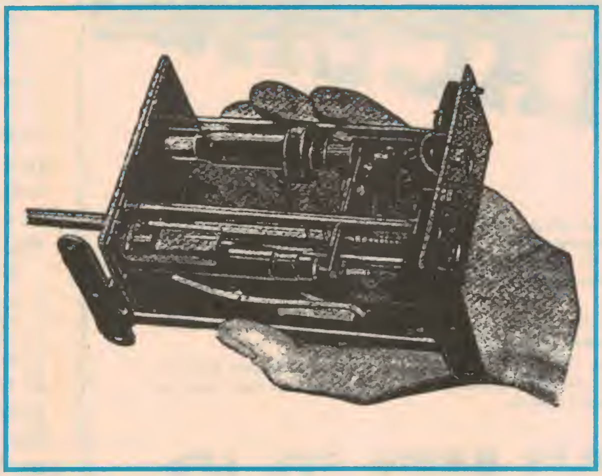


Fig.2: A pre-aligned 'Ferrotune' front end, as advertised in R&H for December 1945: 'Kingsley Does It Again — Another Major Technical Development'. It offered straight line tuning from 540 - 1650kHz with each revolution of the tuning knob covering 100kHz.

There was no secret about the basic concept, but manufacturers were not exactly forthcoming about their research into the physics and chemistry of ferromagnetic materials or how best to process them. Like other manufacturers, Kingsley Radio had to find its own way through the maze.

According to the Lay Cranch interview, Howard Love had a long term strategy in relation to ferromagnetic cores. He included them as soon as practicable in his normal 465kHz IF transformers. His next major step was to place ferromagnetic cups around the outside of the windings, thereby permitting the use of relatively small aluminium shield cans without compromising the 'Q'. His reasoning, as advertised, was that small IF transformers would fit in with the trend to more compact receivers, as well as their increased adaptability as replacement components in existing receivers undergoing service.

Beyond IF transformers, Howard Love was looking to the day when ferromagnetic cores would offer sufficient permeability at higher frequencies to warrant their application in broadcast band tuning coils. Beyond that — the shortwave bands!

The real climax would come with cores large enough to cope with ferromagnetic tuning: tuning would depend, not on a ganged variable capacitor, but on a self-lubricating mechanism of sintered bronze, sliding cores in and out of suitably proportioned coils. For good measure, Howard Love sensed that ferromagnetic cores could well find a role in the production of filter inductors, as required for carrier telephony systems.

Two places at once?

In his interview, Lay Cranch represents himself as an integral part of this whole development:

GH: *"So you developed this and your permeability tuner, using a fairly standard superhet circuit...?"*

LC: *"Yes, it was a Colpits Oscillator set, but what we had to do was to get the permeability up..."*

Trying to explain this involvement, I face the problem that the December 1945 issue of *The Australasian Radio World* carries an illustrated full page advertisement for a Kingsley Ferrotune unit. It follows that the development had to have been done while Lay Cranch was still in Sydney, serving in the RANVR and as nominal manager of Crown. George Neilson confirms this impression, with the observation that Lay Cranch's account of such events could only have been written 'from afar'.

Having in mind that Lay Cranch and Noel Featherstone presented a lecture on sintered bearings to the IRE Sydney Division in that same year, it is reasonable to assume that Lay had kept in close touch with Howard Love during the intervening years and had, indeed, shared in the exercise 'from afar'.

With hindsight it also seems likely that, when Howard Love sensed that he was

being pushed to the limit by his dual management and technical involvement, Lay Cranch was the logical person to enlist as Chief Engineer — so that he could shoulder the latter half of the burden. He understood where Kingsley had come from and in which direction it was headed!

So back t o George Neilson's story:

Ferromagnetic powder

George says that Kingsley had been depending on a separate small Melbourne company for their early ferromagnetic cores, but faced a possible crisis when their supplier experienced difficulty in keeping up with the demand. In an effort to boost their output, Howard Love had apparently sought to inject new capital, and/or to take them over — without much success.

By way of raw material, they had been purchasing the 'detritus' — waste particles — from the grinding operation of an engineering firm producing piston rings. Literally 'sweepings from the machine room floor', the waste was sieved to remove cigarette butts and other extraneous rubbish before being subjected to a reduction process in a high-temperature muffle furnace. This involved placing the sieved rsidue on a tray in a sealed 25cm diameter steel tube, mounted in the centre of the furnace.

Hydrogen was fed through a small tube sealed into one end of the 'oven' and the surplus burned off from an exit tube at the other end. En route, the hydrogen would react with any oxygen present in the detritis, along with other 'muck'. By monitoring the burn-off flame, an operator could tell when the reduction process was complete.

The residue was then processed in a 'rubbing mill', a device 'rather reminiscent of a dough mixer'. Its role was to rub off sharp corners from the iron particles so that, when later coated with an insulating binder, there was less chance of corners projecting though the binder and making metal-to-metal contact between the particles — especially when the mix was forced into heated dies in a hydraulic press.

Facing the supply problem, Howard Love's answer was to set up a new company called Metals Disintegration Pty Ltd, primarily to develop and produce ferromagnetic products for its parent company. His choice of raw material was iron oxide powder called *haematite*, which also needed to be processed in a reduction furnace and a hydrogen atmosphere to absorb the oxygen. In place of raw powdered oxide, the residue was predominatly powdered iron particles.

While Kingsley had what Lay Cranch described last month as their own 'hydrogen bomb', they had no rubbing mill and couldn't purchase one. By then a member of the lab design staff, George Neilson says that it fell to his lot to fabricate one. For those who are mechanically inclined, I repeat George's description of his brainchild, verbatim:

"It consisted of a cast-iron cylinder with hemispherical ends, in which were mounted bearings. Mounted on spindles at each end were propeller-like paddles which were driven by chain drives at slow speed, in opposite directions."

"A rectangular box extension was for loading and unloading, and in operation this was closed by a rectangular plunger with lever and heavy weight applying considerable pressure to the powder."

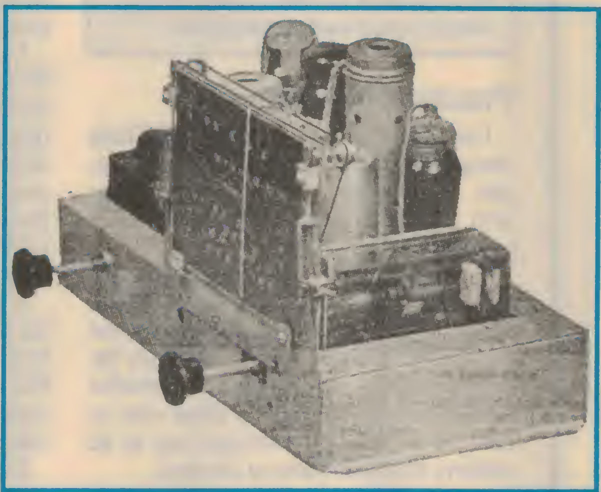


Fig.3: An up-to-date prototype Kingsley-designed 4/5 valve superhet receiver as featured in R&H for May 1946. The Ferrotune assembly is mounted through the near end of the chassis in a position that might otherwise have been occupied by a tuning gang and shielded aerial and oscillator coils.

"Eric Patching, an industrial display artist on the Kingsley staff and an expert in clay modelling, helped me design the paddles. One of each was propeller-like for circulating the powder; the other was paddle-like to rotate the powder and achieve the required rubbing action."

"In operation, considerable heat was generated and the cast iron mill was surrounded by a water jacket for cooling."

"The device proved completely successful."

After processing, the iron particles were mixed with dissolved polystyrene — serving as a binder — then dried, subjected to further milling and finally injection moulded using an eight-ton pressure hydraulic press. The finished cores, of which over 20 were required in each AR7 receiver, were marginal for the purpose because the ratio of iron to binder was rather low.

Iron/antimony alloy

In the quest for a better product, HK went to America and signed agreements with a firm called Polydoroff, which owned patents covering an improved type of ferromagnetic core. Starting with haematite, they added a small quantity of antimony during the reduction process, to obtain an alloy which offered reduced magnetic losses. In turn, the alloy was coated with a phosphate to provide the necessary insulation.

With better cores available, Kingsley subsequently found itself facing a shortage of air dielectric trimmers, of which 28 were required in the five coil boxes supplied with each AR7 receiver. HK decided that the obvious course was to evolve a design and either manufacture them inhouse or contract them out.

George says that, once again, he copped the job and took advantage of earlier lab work with steatite and formaldehyde resin. He was fortunate also in being able to consult with a Melbourne company — a one-time manufacturing jeweller, which had been switched to wartime micro-production of a quite different kind.

Between them, they came up with an eminently satisfactory air trimmer with a notable refinement — stops which indicated to the operator that a trimmer, obscured from view, had reached either limit of its adjustment.

At about this time two of HK's ambitions for ferromagnetic devices materialised. One was the production of toroids and pot cores with adjustable slugs for the then PMG, to use in connection with carrier phone systems. It led naturally to the production of precision inductors, to PMG specifications.

The other development was a prototype variable-inductance tuner, in which George Neilson says he had a key role. That this was not an impossible proposition was evident from a small medium-wave receiver which HK brought back from the USA. While proving a point, it also dramatised how *not* to go about it, if the result was to compete with the conventional system!

A LOAD OF GARBAGE...

Like other wartime manufacturers, Kingsley Radio had to find their way around unexpected material shortages. A key component in one of their products was a long, insulated screw made from Erinoid, a casein material which became unavaible at one stage.

To their intense relief, someone realised that a satisfactory substitute could be made by purchasing a certain size and kind of knitting needle, cutting a thread with a die and then parting it into pieces of the requisite length.

The residue which ended up on the floor — long, curly swarf and off-cuts was ultimately swept up by the cleaner for disposal in the incinerator.

As it happened, the knitting needles were made of cellulose nitrate, so that the swarf translated roughly into 'gun cotton'.

When the cleaner ultimately put a match to the rubbish, he had hardly turned his back before there was an almighty explosion — which fortunately blew the lid off and did no other damage, except to the cleaner's composure!

Practical problems

George says that it proved difficult enough to develop a coil/core configuration that would offer a 9:1 variation in inductance, and hence a 3:1 variation in frequency.

It was even more difficult to avoid the situation where the stations tended to crowd together at the high frequency end of the tuning dial. Last but not least, the distribution of ferromagnetic particles would have to be uniform from core to core, if aer/osc/dial tracking was to be uniform from one tuner to the next.

In fact, compressing the ferromagnetic mix from either or both ends of a tubular die had the effect of concentrating the particle density of the core at one or both ends of the rod. As well, it tended to align the particles with their greatest dimension at right angles (i.e., side-on) to the direction of the field.

In consequence, Kingsley had to rearrange the process to load and compress the particles from the side. This achieved more uniform density and aligned the particles end-on to the field — the preferred orientation — but it also necessitated a grinding operation to ensure that the rods were uniformly round over their whole length.

Unfortunately, it did not prove practical to grade the permeability of the core in the way that capacitor plates are shaped to achieve a linear frequency scale on the tuning dial. It therefore became necessary to cut a variable pitch thread in the lead screw driving the cores.

In the hand-made prototype tuner, a pencil line was inscribed on the 1/4" lead screw, which was tediously transformed into an Acme drive thread by a toolmaker using a hacksaw. Subsequently, a Hercus bench lathe was set up to produce duplicate leadscrews in a semi-automatic operation.

Without going into explicit detail, George indicates that the oscillator was made to track the signal frequency circuit(s) by padding the oscillator with an extra inductor, copper tabs and a conventional trimmer. When the tuners went into quantity production after the war, they found ready acceptance.

In the meantime, Kingsley had become involved in the manufacture of copper powder for use in porous bronze bearings. This involved a plating operation using a low voltage 1500 amp generator, and they found themselves cheek-by-jowel with 2x1" busbars in lieu of wire conductors. They also learned the hard way how not to demagnetise the auxiliary DC field generator when switching off.

In another better-forgotten episode, Kingsley was contracted to produce aircraft equipment which had been developed by the RAAF. The equipment failed its acceptance tests because of a power supply fault and ended up in a three-way contest in the High Court involving the RAAF, Kingsley and the transformer manufacturer.

It transpired that the RAAF had used a Variac to determine the required transformer voltage, losing sight of the fact that a practical transformer to fit in the equipment would exhibit a much higher internal impedance...

George Neilson says that he resigned from Kingsley after the war to set up his own business but, while he supplied test equipment for their production line, he was not otherwise a part of their postwar activities.

At this point, the story of Howard Kingsley Love must revert to Lay Cranch's account, in the June issue, of his sudden death and the consequent demise of his company, in 1948. But in a phone conversation, George said that he understands HK's death was due to heart failure, brought on by overwork.

He added that HK was a natural motivator, and whenever the staff saw him touring the factory with a Director in tow, they were pretty sure that he would be 'selling' a new proposition.

When HK passed away so suddenly, the Directors simply couldn't cope with the idea of Kingsley Radio operating without its founder. So, to the dismay of Lay Cranch and its staff, they wound it up! ❖

SHORTWAVE LISTENING

with Arthur Cushen,

More special programmes for DX enthusiasts

Special programmes for shortwave 'DX' enthusiasts have been provided since the 1940's, when they were pioneered by Radio Australia. Nowadays many international broadcasters run programmes of this type — covering shortwave communications, giving frequency and transmission schedule information and answers to letters from listeners.

Australia was in fact, the first country to introduce a special DX programme — in May 1945 Radio Australia introduced a series prepared in Adelaide by the then South Australia DX Club and Ernest Suffolk. Of those involved in its introduction, only Rex Gillett still lives in Adelaide and continues his hobby of shortwave listening.

After the initial broadcasts prepared in Adelaide, they were taken over by Graham Hutchins who continued with the session named Australian DXers Calling.

By 1971, the programme was known as Radio Australia Listeners Club. In 1981 the name was changed again to Spectrum with Dick Speekman as host. Today, the current Communicator programme is more or less devoted to electronics.

Keith Glover was also popular in the late 1970s with his Club Forum programme, which included answers to listeners' letters and providing some DX tips.

The idea promoted by Radio Australia was soon copied by other international broadcasters. Radio Sweden commenced Sweden Calling DXers in 1948 with Arne Skoog as presenter. Arne Skoog broadcast the session weekly until his retirement in 1981. George Wood then continued with Sweden Calling DXers until 1990, when the name was changed to Media Scan.

The most popular programme with shortwave listeners worldwide is now Media Network on Radio Nederland, broadcast on a Thursday. This series had its beginning in the late 1950's, with Harry van Gelder and DX Jukebox. By 1966 when the writer joined this programme, there were four contributors; today I am the sole reporter. The presenter is Jonathan Marks. Each month we carry shortwave news from the Pacific, which is carried in eleven transmissions — not only from the transmitters in Holland, but from Bonaire, Madagascar and even transmitters in the former Soviet Union.

Another long running series was from Montreal, with the Radio Canada Shortwave

Continued on page 61

WORLD DX PROGRAMMES

Some of the more interesting international shortwave programmes are as follows:

AUSTRALIA: Communicator, Tuesday 1930UTC; 7260kHz
BELGIUM: Radio World, Monday 0630; 9925
CANADA: The Mailbag, Sunday 2115; 13,650
ECUADOR: HCJB, Saturday 0740; 9745
JAPAN: Media Roundup, Sunday 0520; 17,810
NEW ZEALAND: Mailbox, Thursday 0830; 6100
NEDERLAND: Media Network, Thursday 0753; 9720
SWEDEN: Media Scan, Tuesday 1240; 15,240
SWITZERLAND: SW Merry-Go-Round, Saturday 0900; 9885
UNITED KINGDOM: BBC Waveguide, Saturday 1030; 9740
USA: KWHR World of Radio, Saturday 0900; 9930.

AROUND THE WORLD

ALBANIA: Radio Tirana has withdrawn the right of the BBC to operate its programme on mediumwave, and a deadline has been set for September for the use of the FM relay from Bush House.

This attitude, generally regarded by broadcasters as the 'gatekeeper' is at times taken by Governments who are relaying another broadcaster when they feel the incoming broadcast which is relayed on their transmitters is against local policy, and broadcasts can be terminated.

BRAZIL: Radio IPB AM Camp Grande has been heard at 0400UTC on 4895kHz with a gospel programme in Portuguese. The broadcasts have been received at 0400 on Sundays and it would seem that the schedule has been extended as the sign-off time is generally 1300 daily.

COSTA RICA: Radio for Peace International, broadcasting from Santa Ana, has been heard on 9400kHz with a USB transmission. Reception has been on Saturday at 0440UTC when a Mailbox session in which letters from listeners are answered is a feature. The same broadcast service is heard on 7375kHz and that transmission is on AM.

Another broadcast from Costa Rica is AWR heard on 6105kHz at 0600 in Spanish. From Monday - Friday this frequency is used by Radio Canada 0500 - 0600 and after that time there is good reception of the programme. English broadcasts have been noted around 0900UTC.

HOLLAND: Major changes have been announced by Radio Nederland and these have to come out of the existing budget. This will mean the end of broadcasts in French, Indonesian, Arabic and Portuguese, and these languages will no longer be carried in direct transmissions. Plans are under way for more stations to take existing programmes from Hilversum off the satellite, similar to the projects in Dutch and Spanish to Latin America.

Rebroadcasts of their programmes in English to Asia, Australasia, North America and the Caribbean are also to be inaugurated. There will be a joint venture to run the Radio Nederland Caribbean relay on Bonaire.

HONDURAS: A new station is Radio International, broadcasting from San Pedro Sula on 4930kHz. Transmissions commence at 1100UTC with an English recording and then follows complete station details in Spanish including reference to mediumwave and shortwavefrequency.

INDONESIA: Radio Republic Indonesia from Jakarta has been well received on 9680kHz, with news in Indonesian at 1000 and 1100UTC. The transmission often carries sporting broadcasts as well as local programming, but breaks on the hour for the news.

PALAU: KHBN recently added a second transmitter and a new schedule has been announced, with the first frequency in use 9830kHz now operating 0700 - 1600, 2000 - 0100. The second transmitter is scheduled on 9965 at 1200 - 1900, 2100 - 2400; 17,630kHz at 0000 - 1200 while an alternative frequency of 15,140kHz is scheduled 2000 - 0600UTC.

PAPUA NEW GUINEA: Port Moresby, which introduced a 100kW transmitter earlier in the year, has reverted to its old tropical band frequency of 4890kHz for its morning and evening broadcast. This frequency has been heard from 2000UTC and again closing at 1400UTC, while the balance of the broadcast which is a daytime frequency in New Guinea is on 9675kHz — a frequency used in past months.

RUSSIA: The broadcasts of AWR Russia over a transmitter of Radio Moscow have been heard on 13,615kHz. The transmission is in French and this frequency is also used for other language programmes for reception in Europe.

SINGAPORE: Radio Singapore has been received with world news at 1000UTC on 6155kHz. This is a relay of the Domestic Service, while the new Radio Singapore International continues to be observed at 1100UTC on 9530kHz.

USA: WRNO New Orleans has been broadcasting in Spanish on 7395kHz up to closing at 0500. According to the closing announcement, the broadcast is for reception in Europe and North America and the station has the slogan WRNO Worldwide. It was one of the first private shortwave stations in the United States.

This item is contributed by Arthur Cushen, 212 Earn Street, Invercargill New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 10 hours behind Australian Eastern Standard Time and 12 hours behind NZ Standard Time.

Moffat's Madhouse...

by TOM MOFFAT

Processing the all-important image...

I've just been reading a most profound book. It's called *West of Eden — The End of Innocence at Apple Computer*. It's the work of a fellow named Frank Rose, a journalist and technology writer. The author's photograph on the dust jacket shows a face delivering a smarmy sneer, and when I saw it I thought "Ah, here we go... another one of those California hype-artists is going to lay a little bulldust on us".

But no, that was not the case at all. Frank Rose understands. It appears he has searched for, and found, the truth. I borrowed the book on impulse, at the far end of a New Year's Eve party; but when I started reading it the next day (headache and all), I was hooked.

The guy at the centre of the book, Steve Jobs, was the founder of Apple Computer in a roundabout sort of way. Another fellow, Steve Wozniak, was the technical brains behind the deal. But, at least in the treatment in *West of Eden*, Jobs was the star of the show at Apple computer at least.

In the beginning, Jobs and Wozniak did what I do, and what many of you readers do — they were electronic fiddlers, and when the first hobbyist computers came along they just had to be in it. Prior to that Jobs and Wozniak were happily cruising along through life, entertaining themselves and making a bit of money by phone phreaking (See Moffat's Madhouse, January 1994).

The heart of the Phone Phreak movement was the infamous Blue Box that let people make long-distance telephone calls without paying for them. The original model, designed by the notorious Captain Crunch, was a complex contraption that used more than $1500 worth of parts. Wozniak, the quintessential electronics nerd, quickly figured out how the Blue Box worked and designed his own model — much smaller, with only $40 worth of parts.

It was Jobs' idea to manufacture the Blue Boxes. Then Jobs and Wozniak went door to door, selling the gadgets to students at the University of California at Berkeley for $150 a pop. At that time a fellow named Dick Smith was flogging the new CB radios to Australia's hungry pirate operators. And a fellow named Tom Moffat was building illegal police scanners into television news crews' camera cases. Those were the days when life was a little freer and easier — and dare I say, more fun!

Steves Jobs and Wozniak got into the computer business by setting up a workshop and factory in Jobs' parents' garage. They were members of the Homebrew Computer Club, and they felt the challenge to homebrew a computer that was just a little bit more clever than what the club's other members were doing.

The result was the Apple II. The name came from the fact that Jobs had just spent some time apple-picking.

Very clever design

If you ever look closely at the design of the Apple II, you'll see that it was a *very* clever piece of work indeed. Wozniak had the same philosophy that I do — trying to make a particular circuit do its stuff in new and simpler ways not thought of in 'classic' designs. So the Apple II was indeed weird inside, particularly in the way in which it produced colour graphics. I have read about this several times and still don't understand it.

It just happened by chance that Wozniak and Jobs were living right smack in the middle of California's Silicon Valley, the centre of the earth as far as technology is concerned. At the time, 'computer' meant mainframes, of course, and nobody would take seriously an abomination with only 4K of memory, built by a couple of amateurs. But eventually a forward thinking ex-Fairchild engineer, Mike Markkula, saw the *potential* in Apple. He coughed up $91,000 of his own money and arranged a line of credit for a further quarter million, and Apple Computer entered the big time.

This is the stuff all of us dream of — designing/inventing some new mega-clever electronic gadget and then getting 'discovered' by a business entrepreneur with a fat bankroll. But in the case of Jobs and Wozniak, it was probably the worst thing that could have happened to them. From then on the fun was gone; the little Apple in the garage got 'corporatised'.

There is a particular work ethic in Silicon Valley that was rampant in the early days of Apple and survives to this very day. I know this for a fact because I have a daughter living in Cupertino, California, the epicentre of Silicon Valley and the corporate home of Apple Computer. Her husband works for a software house, from 8:00am until sometimes after midnight. The whole scene is pressure! Pressure! PRESSURE!

They all make lots of money of course, and the word 'recession' is unknown there. They drive around in fancy cars, and they wear designer jeans to work. And in many companies, software designers work in little cubicles. So you get 16 hours a day in a tiny cell, then you hop into your Porsche to drive home and crash into bed before another day of the same.

I read in the *Australian* only this week that many Silicon Valley companies are actually allowing their workers out of their cells for little walks from time to time, and some companies even let them commute between buildings on roller-blades. What an existence, eh? I certainly couldn't take it. Today I'm working at the picnic table behind our beach shack. I didn't get here in a Porsche and I've got no guarantee I'll have any work at all tomorrow, but at least I'm not 'stressed out'...

As Apple Computer grew, the corporate structure grew with it. Wozniak had been sort of shuffled aside early in the piece (no nerds, please!) and Jobs was looking for some management expertise to help him run the company. He eventually brought in John Sculley, who was NOT a computer industry guru. Instead Sculley came from being president of Pepsi Cola. He was a marketing man,

and he could sell *anything* — be it computers or soft drinks.

John Sculley was responsible for the concept of 'The Pepsi Generation'. And here is a significant truth fleshed out by author Frank Rose: Sculley wasn't selling a drink at all, he was selling a lifestyle. It made not the least bit of difference if the drink tasted like bilgewater; if you drank it, you were immediately one of the beautiful people. You would develop an instant sun tan and lovely women would flock to your side, all because you drank Pepsi!

This is not to say that Sculley had a lousy product. He put his money where his mouth was, by consuming enormous quantities of Diet Pepsi while working at his desk, even after he left Pepsi for Apple Computer. (I've even developed the habit myself, since going off the beer and onto a diet. A big night out for me means a six-pack of Diet Pepsi nowadays — not selected to bring me into the Pepsi Generation, but because it tastes good.)

John Sculley was an early practitioner of 'image'. Image means that what a product does, and how well it does it, are secondary to how it looks and what your ownership of the product tells other people about you. So, with Sculley at the helm, buying an Apple didn't mean buying a computer, it meant buying a lifestyle. Owning an Apple computer was 'hip'.

But there was a problem. Sculley was still more-or-less sharing his job with Steve Jobs, and Jobs' image wasn't so hot. In *West of Eden*, Frank Rose described him as 'smelly and unkempt', and Jobs was slowly moved sideways — away from the yuppiedom of management and into the ranks of the engineers, out of sight.

The Apple II also caused a bit of consternation, because although it was technically brilliant and innovative, it was a nerd's computer; designed by nerds and used by nerds. What was needed was something that looked nice sitting on a desk. And it had to produce very sophisticated graphics on the screen. The result was the ill-fated Lisa, soon followed by a smaller and cheaper model, the Macintosh. Ah, here was a more suitable IMAGE!

Trouble is, the early Macs only had enough memory to hold the screen display and little else. There was no room at all for an actual application program of any sophistication. As Apple people themselves admitted, it was a lovely computer but it couldn't *do* anything. But — and here's the interesting bit — people, and big companies, bought them anyway. It looked just great, and increased one's status enormously, to have a Mac sitting on your desk.

Presentations!

Why this interest in graphics? Presentations, that's why. The early IBM PC's could do lots of things — word processing, accounting, databases — but they could display only text on the screen, in glowing green characters. And instead of columns of numbers, the image-makers decided it might be easier to sell their Pepsi or whatever if data could be displayed as pie-charts or bar graphs; anything other than dry numbers. It was decreed that all 'serious' computers would henceforth work with graphics instead of text, and the Mac was waiting in the wings to step upon the stage.

The IBM of course had to follow suit, thus giving birth to Windows, a graphics system to make it look just like the Mac. And to make practical use of the graphics, it was necessary to replace old text-based printers like the excellent daisy-wheel models with printers capable of producing images on the page. And any serious printer nowadays can't just be a simple dot-matrix design; a laser printer is required.

Presentations! Is that what business is about today? Reading *West of Eden* gave me an idea of how big business is conducted in the computer age, and it seems every company meeting, even small get-togethers, were and are subjected to never-ending presentations. What I'm starting to wonder, though, is this: is the quality of the presentation now becoming more important that the idea or data being presented?

For example: in schools nowadays, no kid would be seen dead handing in a report or project hand written. To compete with other students, the report must be written and printed on a computer. Up to now my kids have been happy to use my 286-based machine with its elderly C-Itoh dot matrix printer and my faithful 'VDE' text-based word processor. This system produces some lovely-looking documents, in my opinion.

But now many students are submitting their work printed on a laser printer, so it looks almost typeset. This raises the question — will those students with laser-printed projects get better marks than they would have if the documents had been printed on a dot-matrix printer?

A friend of mine is so convinced this is true that he takes all his kids' schoolwork in to a computer bureau to be laser printed, at 30 cents a sheet. If graphics and presentation are so important, why is it that most of the world's great writings are text only? The only graphics in Frank Rose's *West of Eden* are on the dust jacket. Inside, there's only words.

Another book I've just finished reading is a novel, *The Fog*, by James Herbert. There's enough horrific images in there to scare the whoopee out of anybody, but they're all presented in pure text. Only the writer's skill brings the images to life.

And what about what must be one of the most famous speeches of all time, Abraham Lincoln's Gettysburg Address? An early speech synthesiser for the Apple II computer could recite the whole Gettysburg Address as a demonstration of its capabilities. As for the speech itself, Lincoln wrote it on the back of a table napkin!

Back to the Mac: it has now grown in memory, sophistication, and capability, and there are now heaps of real-world application programs for it. The Macintosh is particularly big in education and the public sector. One does not have to be a computer expert to use it; you just point the mouse and click.

I must admit I am somewhat baffled by the Mac-IBM situation. The Mac, which certainly has 'image', seems to be most popular in government, and among universities and their research institutions. Private owners of Macs are among the best educated and qualified people. Yet the experimenting, 'hacking' ethic that got Apple going in the first place doesn't seem to be there any more.

As many of you know, a good part of my own working time is spent developing electronic projects such as computer-based weather fax and satellite decoders. Over the years hundreds of kits have been supplied for use with the IBM-PC, and after many requests, for the Commodore Amiga. But as for the Mac, we haven't exactly been rushed with requests for kit projects.

Is this just because Mac users aren't interested in experimental stuff, or is because not a lot is available, so Mac users don't expect it? Well, it looks like I am about to test the Mac waters, because due to certain academic pressures on my university-student daughter, a Macintosh may soon take up residence in the Madhouse. (Then we'll have Moffat's Macintosh Madhouse.)

Should this occur, I just can't let such an interesting machine go to waste doing only school work. So it looks like I'll have to produce Macintosh versions of the Listening Post weatherfax and satellite decoders. With such goodies available, maybe Mac people will be inspired to join in on some good experimenting. ❖

FORUM

Conducted by Jim Rowe

In defence of amateur radio and the WIA...

It took them quite a while to respond, but there's finally been some letters from unhappy radio amateurs replying to those complaints we published in the November, February and May issues, about the unpleasant behaviour of some of their fellow hams — and in one case presenting a decidedly gloomy picture of the future of both amateur radio and the WIA. The letters have come from both individual amateurs and the WIA's Federal President.

As I wrote here in the May column, I was a bit surprised that we didn't get a faster response from amateurs in response to Tom Moffat's original complaint about unpleasant behaviour on the ham bands, in the November issue.

Often amateurs are very quick to defend their activities from any suggestion of criticism — almost to the point of revealing a 'sacred cow' syndrome. Yet most of the initial response we got to Tom's criticisms came from non-hams essentially backing up his complaints, as you'll perhaps recall from the February and May columns...

All the same, I had a feeling that if *anything* would produce a few defensive letters from amateurs, it would probably be that one from the 'old fogie', in the May column. This was the letter that really 'went to town' about factional fighting in the WIA's NSW Division, you might recall, and went on to suggest that traditional amateur radio had little or no future in the ongoing communications revolution. It was pretty strong stuff — clearly intended to get people thinking, talking and very likely writing.

Well, it certainly did. About the second week in May, they started arriving. And the writers were predictably not very happy, as you'll see shortly. In fact the impression I got from quite a few of them was that the cauldrons of tar were being heated up, and the frozen chicken factories raided for bags of feathers — in preparation for a visit to our editorial offices, and mine in particular!

Actually I'm not at all unhappy about having stirred up this kind of a reaction; quite the contrary. It's an old adage in publishing that unless you get at least *some* complaining letters, you're not doing your job right!

At the very least, even critical letters show that your magazine is being read, and attracting people's interest...

In this particular case, my view is that if amateur radio has problems, the best way to ensure that they stand a good chance of being fixed is by holding them up for all to see and acknowledge. So I make no apologies for doing so, even though this has clearly offended those with the opposite view.

Anyway, enough preamble from me. Let's give the people who've written in a chance to state their case too, so the subject at last gets a balanced treatment.

VK3 amateur

The first letter I'm presenting comes from Ken Simpson-Bull, VK3NJ, of Glen Waverley in Victoria. Here's what Mr Simpson-Bull has to say:

I write to protest at the amount of 'ham bashing' that's been going on in these columns over the past few months. Apart from the few misguided and largely inaccurate statements about the Wireless Institute (which provides an absolutely essential service), the comments have related to the alleged poor social behaviour of amateur radio operators.

Now I've been active on the HF and VHF bands for nearly 20 years, and in all that time I can honestly say that I have only heard (or seen) a dozen or so occurrences of the type of behaviour currently being attributed to hams as though it were a daily event. Sure, one hears the odd 'bloody' or 'bugger', but far coarser language can be heard any night on prime time television. And some breaches of manners can more often be ascribed to ignorance rather than intent.

There are over 18,000 licenced amateurs in Australia. Those guilty of anti-social behaviour, assuming that the transgressors are indeed all qualified hams, would (I guess) probably be less than 200. That's about 1% of the group, and probably the same percentage as in any group — say doctors, lawyers, bricklayers, or editors of technical magazines — who would be capable of unbecoming behaviour.

So why then single out hams? Why don't we say 'let doctors police their own group'?

On air, I am always treated with the utmost courtesy, offered extensive assistance carrying out radiation or transmission quality checks, and have no difficulty in getting response to my CQ calls — even on two metre repeaters! In return I always offer reciprocal service. So let's have some positive support for this worthy group of fellow electronic enthusiasts.

Thanks for those comments, Ken, and I certainly take your point about a lot of 'coarse language' being heard almost any night on TV. Mind you, the producers of prime time TV shows are not trying to maintain an image of being responsible technical experimenters, as radio amateurs claim to be; they're clearly fighting a 'no holds barred' battle for ratings and advertising dollars.

You're no doubt right in suggesting that some of the 'breaches of manners' are possibly due to ignorance rather than intent, too. However the kind of extremely rude behaviour that Tom Moffat originally complained about probably doesn't fall into that category, I suspect.

Perhaps people are a little more civilised down in Victoria, but like Tom I've certainly heard some very unpleasant behaviour from NSW amateurs — particularly during contests. I'm not sure how you could ascribe that kind of thing to ignorance, rather than sheer 'I'm going to get more contacts than

anyone else today, and no-one better try and stop me' nastiness...

I'm sure you *are* right, Ken, in suggesting that the people whose behaviour has attracted this kind of criticism are very much in the minority. You've made the percentage seem lower than it is, of course, by quoting the figure for licensed amateurs rather than *active* amateurs; I've seen figures from the WIA itself suggesting that fewer than half of those with licences are active on the bands. So the real percentage figure is probably nearer double what you've suggested — but still a very small proportion of the total active amateurs. And as you suggest, no worse than the proportion of such people among doctors, lawyers, bricklayers and editors of technical magazines (funny you should think of *them*, isn't it?).

The problem is, though, that even a small number of 'unpleasant apples' tends to give amateur radio a bad name. That's *why* we've been 'singling out' hams for criticism — in the hope that all of the good guys can exert a bit more pressure on the people concerned.

I suppose the reason why we've 'singled out' hams for mention here in *EA* is that hams are after all fellow electronics enthusiasts, as you say yourself. So it's rather more appropriate than for us to tackle problems with doctors, lawyers or bricklayers, wouldn't you say? Or even magazine editors — we have a Press Council which jumps on *us*, if we step out of line...

WIA response

Moving along, the next letter I'm going to present for your interest comes from the WIA itself — or to be more exact, from its current Federal President Neil Penfold VK6NE. It's on offical WIA letterhead, and is fairly obviously meant as an official reply to the letter from our 'old fogie', in particular:

The WIA notes with considerable concern your comments in the 'Forum' section of the May 1994 issue of 'Electronics Australia'.

You saw fit to publish an letter from an unidentified longstanding member of the New South Wales Division of the WIA, who shows by his comments that he fails to understand the structure and function of the WIA. He also argues that, since there has been a problem in one Division, the whole body is senescent. The WIA disputes this.

The WIA enjoys considerable standing both nationally and internationally. It is represented on advisory committees of the International Telecommunications Union (the world regulatory body) and supplies a Director to the International Amateur Radio Union. The WIA is also represented on the Radio Communications Consultative Council and Standards Australia committees.

WIA delegates have attended all post-war WARCs and all IARU Regional Conferences. The 10, 18 and 24MHz bands were gained for the amateurs as a direct result of such participation.

From negotiation between the WIA and the (then) DoTC, Australian amateurs gained the original Novice licence and its subsequent extensions of privileges, a considerable level of deregulation and an examinations service geared to the needs of the candidates. Other WIA initiatives have resulted in avoidance of import duty on amateur transmitting equipment. Ongoing negotiations between the WIA and SMA will further deregulate the amateur service, increase privileges for Novices and Combined licensees and create a new licence entry level.

The future of amateur radio need not be as bleak as your correspondent claims. While commercial interests are indeed providing vastly improved services, no modern technology can replace

the amateur's ability to call 'CQ' and receive a reply from a like-minded enthusiast on the other side of the world, free of charge and in an international language. The amateur service has a unique ability to contribute to international goodwill and understanding between diverse peoples. If for no other reason, the WIA must continue its effort to maintain and extend privileges for all amateurs. It can only succeed if it has the support of the whole amateur population.

I appeal to your readers who are interested in the activities and functions of the WIA to seek the information from the appropriate source, their State Division or the Federal body of the WIA, rather than from biased comments from a disenchanted but anonymous correspondent to a commercial magazine.

Thank you, Mr Penfold, for ensuring that the official WIA position is made clear — at least regarding some of the points that were raised by our 'old fogie' correspondent. It's perhaps a pity that the WIA was only moved to respond when *that* letter was published, and even now seems to have chosen to ignore most of the other criticisms.

There *does* seem to be a distinct whiff of 'sacred cow' indignation in the letter, too — with descriptions like 'shows by his comments that he fails to understand', and that last snipe about 'biased comments from a disenchanted but anonymous correspondent to a commercial magazine'...

Honestly, I don't think *anyone* would argue that the WIA hasn't achieved a great deal for Australian amateurs. I'm sure even our 'old fogie' would be happy to agree. In that sense, then, the WIA undoubtedly *does* deserve support — and in particular, that of radio amateurs.

Beyond criticism?

But surely that doesn't mean that the organisation, its structure and operation are beyond criticism, by its own members or anyone else? To my mind, this *would* be the best way to ensure that the WIA becomes moribund. Organisations which never allow open criticism of their structure or function have a tendency to become complacent and inward-looking, and the WIA already displays signs of this phenomenon. Perhaps a period of honest and open re-appraisal would do it a power of good, and ensure that it does have a healthy future.

The last paragraph of Mr Penfold's letter *does* concern me, because his comments suggest that the WIA regards anyone who airs their criticisms of the organisation in a 'commercial magazine' as being *by definition* disloyal. This certainly suggests an inward-looking organisation, don't you think?

Bearing in mind that only about one third of all Australia's radio amateurs are currently members of the WIA, whereas the audited circulation of *EA* is well over the total number of licensed amateurs, it's quite possible that more amateurs may read *EA* each month than the WIA's own *Amateur Radio*. I'm not saying this merely to skite, or to denigrate *AR* (which is a fine publication), but merely to suggest that our magazine is not at all an inappropriate medium to discuss any problems which concern radio amateurs and those with allied interests.

Quite appropriate...

We *are* certainly read by a lot of hams, and many of these may not even be members of the WIA. It seems therefore quite appropriate that we discuss such topics, whether we happen to be a 'commercial' publication or not. Although the WIA may wish to use this term as a denigration, not surprisingly I for one don't see it as such.

By the way, Mr Penfold's claim that only amateur radio provides the only means for people across the world to communicate 'free of charge' is probably one which many people would now regard as worthy of debate. The act of communication itself may be essentially free of charge, but the equipment required to do it really isn't, is it?

If we're talking about Morse or 'CW' communication, which was presumably what Mr Penfold meant (from his reference to 'an international language'), this may involve relatively low equipment cost, but also requires exercising a high level of skill. A skill which is often only acquired with a significant investment of time — and for many of us, time is just as valuable as money.

Nowadays an increasingly large number of people are communicating via computers, modems, bulletin boards and data networks. The cost of communicating in this way is steadily falling, in fact, and it may well be that before long both the equipment and 'connect time' costs of this approach will drop below those of amateur radio — low though the latter may seem.

So there's little cause for complacency, especially as communicating via a computer tends to require rather less skill than communicating via Morse — making it potentially more accessible to more people...

Perhaps the WIA might do better by promoting the unique rewards and satisfaction to be gained by making such contacts using equipment that *you have made yourself.* That was one aspect of amateur radio I personally found most rewarding, when I had any time to devote to it.

Further viewpoint

Moving on again, here's another letter from an amateur keen to take up the cudgels. This time it's from Mr Bob Elms VK6BE, of Albany in WA, who offers some interesting specific replies to both John Smith and 'the old fogie'. See what you think:

I don't usually get too stirred up by topics in your columns, but the comments on amateur radio in the last issues were too much for me to stomach.

Firstly I have held an amateur radio licence for 39 years, so I qualify as an Old Timer. I still operate Morse code at times, the mode that has 'died out' according to your anonymous NSW correspondent, but which to my ears is still quite obviously alive and well, and still in common use world wide on all bands including VHF.

I operate packet radio, I still build gear. I assist young enthusiasts who are trying to qualify; I am 71 years of age. What's more, I am not a unique specimen of the amateur fraternity, I know of many others who are pretty much as I am. According to your correspondents, we no longer exist. Thank you very much but we are still here, and in number.

Perhaps your correspondents, both the SWL and the anonymous NSW amateur should get with the real world. Just for a start, let me say that I recently spent a couple of years monitoring illegal radio operation on various parts of the spectrum, and have heard unlicensed pirate operators using various frequencies, using amateur gear and operating under various call signs, including amateur calls.

Does John Smith really have any proof that the group he heard on 13MHz consisted of genuine licensed amateurs? Or did he just assume that they were amateurs because they were using amateur callsigns? It seems to me that licensed amateurs would be crazy to operate out of band and risk losing both licence and expensive radio gear. If they did have a cosy private net out of band, why on earth would they be so silly as to use their amateur callsigns? Sorry, but it doesn't ring true to me.

Other remarks of John Smith's seem to me to be a little too emotive to ring true. 'Hated CBers'? Who hates them? It's not likely that amateurs would waste time on

hating the group which has provided most of the new amateurs over the past few years.

His other remarks about OT's could well apply to any other group in society. We are not all angels. Suffice it to say that most amateurs of my acquaintance go out of their way to help the inexperienced, rather than make fun of them. Come on Mr Smith! The chip on your shoulder seems to be as big as a karri log, and that's some log!

'Long on rhetoric...'

The anonymous VK2 goes a little too far to have credibility. He is long on rhetoric, but mighty short of fact.

We know there have been problems in VK2, but NSW is only one part of Australia, not the whole of it. We know also that a recent new election in that state returned most of the Council which had been previously criticised by a certain group. It's up to NSW amateurs to sort that one out, but don't tar the rest of the continent with the NSW brush, thank you.

As for the rest of his letter, it won't bear scrutiny. 'Morse code has died out... conversation has died out' — when did he last turn on a receiver? 'Home building has died out' — has it? Of course it hasn't. Many amateurs still build gear. 'Helping others has died out...' Certainly obsessed with death, isn't he?

That VK2 may not have his head in the sand, but he cannot see beyond the keyboard of his typewriter, or is he 'with it', to the extent that he uses a computer, as an OT like me does? 'Amateur radio is dying out', he goes on. Is it? Sorry, but I had not noticed; the amount of activity on the bands at present didn't seem to be a symptom of the demise of what still seems to be a very popular hobby.

I wonder what is his concept of amateur radio? Men (no women?) busily plying soldering irons, before rattling the key on 40 metres to experiment with propagation to the US of A? Come on, Mr VK2, amateur radio has become a very diverse hobby — or hadn't you noticed?

The VK2's remarks about the WIA may follow a popular line among a certain group among the amateur fraternity. However anyone who claims that Australian amateur radio can exist without the support of the WIA is deluding himself.

Amateur radio suddenly seems to have collected among its ranks a fair swag of detractors, most of whom claim to be dedicated amateurs, but most of whom spend a lot of time criticising their fellow amateurs, or the WIA (popular target that one!), and most of whom seem to be asking others to provide the answers to their problems, but cannot offer any constructive comment themselves. Who needs enemies when we have friends such as these?

Perhaps we could ask our 'old fogie' from NSW to give us some answers himself. He says he knows what is wrong; perhaps he can give us a plan. He is the one doing the complaining, but he wants us to provide the answer to his problem. Why put his burden on our backs? Most of us seem to be fairly happy with the current situation. It's the few who are knockers that are our main problem.

Incidentally his need to preserve anonymity is open to some question. Is it really that bad in NSW? If it is, surely the solution would be to move to another more civilised state.

And please, please look beyond the borders of NSW when you talk of amateur radio. Maybe some of the other states may be doing it a little better than NSW at the present moment. We ARE here. We do exist. Please take us into account too.

Well, there you are. Thanks to Mr Elms for those comments, which I think you'll agree are quite interesting and thought provoking. It's nice to know that there are still quite a few amateurs out there like Mr Elms — building their own gear, helping newcomers and generally keeping the traditional spirit of amateur radio alive. And it's also good to hear a clearly expressed rebuttal of the claims made by 'the old fogie', to balance the discussion.

Perhaps it's a pity that Mr Elms seems to regard anyone who expresses any criticism of amateur radio as a 'knocker' and 'our main problem', because often when an enterprise or organisation has problems, they're only fixed in response to criticism. If no-one voices any criticisms, nothing tends to get done...

Out of band net?

By the way, Mr Elms does have an important point about the supposed out-of-band operation by a bunch of amateurs in 1989, as related by John Smith. Somehow the story just didn't ring true, because as Bob Elms says, if they *were* deliberately operating out of band, they would hardly be so silly as to give their amateur callsigns.

Of course there's no reason whatever to doubt Mr Smith's honesty or sincerity, in relating the story. So that leaves the possibility that he and his fellow DX listener might have been somehow misled into thinking that the people concerned ***were*** working out of band, when they really weren't.

FORUM

As it happens, a possible explanation for this puzzle came from the person who started this whole debate in the first place — Tom Moffat, VK7TM. Only a couple of days after the May issue was published, this message arrived from Tom in a fax:

I think one of your Forum correspondents in the May issue may have a little egg on his face. John Smith, of Middleton in South Australia complains of some amateur stations operating out of band on the 13MHz band. I don't know what kind of receiver he was using, but I suspect it was a single conversion El-Cheapo, possibly one of those old Lafayettes.

Mr Smith grizzles about all the CW stations working on 13.112MHz, but if his receiver is a single conversion type with a 455kHz IF, and the local oscillator is below the signal, then he is most likely hearing an image 910kHz (2 x 455) below the real signal. So these 'illegal' operators would actually have been transmitting on 14.022MHz, nicely in the CW portion of the 20 metre band. Oh dear!

Thanks, Tom, and your explanation certainly sounds plausible. Single conversion receivers with a 455kHz IF can have quite modest image rejection at 14MHz, of course, and strong signals on the image frequency could easily break through and give the impression that they were working out of band. Since the mode was CW, according to Mr Smith, it would probably not have been easy to tell that one was monitoring the signals as an image rather than the primary tuned frequency.

Might care to clarify...

Perhaps if Mr Smith is reading this, he might care to clarify whether or not he and his colleague were using single conversion sets with a 455kHz IF. If they were, that might settle the question. And they wouldn't be the first people to be misled by images, would they?

Actually, the same possible explanation came from Bob Elms, in a short follow-up letter. So in the interests of balanced coverage, I'll present his further comments as well:

I hope that you can indeed discuss the matter further in a future issue of the magazine, as some pretty serious criticisms were made of amateur operators — some of which I find hard to accept after 39 years in the hobby. There should be an opportunity afforded for an amateur to defend his colleagues and the hobby.

However to say that was not my real reason for writing again.

I wished to ask whether no-one had considered the possibility that our SWL friends may have been using receivers with a 455kHz IF? If they were, there would be a distinct possibility that the amateur net they heard on 13.112MHz was actually on 14.212, and what they were hearing was a 'double spot'. The fact that a second SWL confirmed the frequency for the first does not mean a thing if he also was using a receiver with a 455kHz IF, even if it were a 'better' receiver.

There you are, then. Perhaps Mr Smith and his colleague may well have been misled by the image response of their receivers; it's a plausible explanation for what would have seemed like out of band operation by the CW operators. If this was the case I hope Mr Smith won't feel too bad; images can be deceptive.

Hopefully we've now given the amateur radio debate a fairly balanced airing, and we can give it a rest for a while. I have quite a few letters on other topics, waiting to be discussed, so next month I'll present a few of these. I hope you'll join me. ❖

Subwoofer system

Continued from page 31

at 120Hz when tested with 4-ohm car speakers. Of course, the slightly worrying aspect here is that the impedance curve would be quite different with other speakers, and could even drop to lower levels in some cases.

Conclusions

All in all, we found the RE/SPONSE subwoofer to be an impressive little unit. While we can't guarantee that it will provide a useful improvement to the low-end response of *all* small speaker systems, we're confident that it would work well with the most contemporary setups.

We didn't have the opportunity to test the unit with a car sound system by the way, but we imagine that it would also suit that application.

In all cases though, you would need to determine that the amplifier involved is happy to drive a 4-ohm load, and be aware that the overall load impedance *can* dip below this figure, depending upon the characteristics of the main speakers.

On music signals (rather than continuous tones) however, most amps should take this type of load in their stride. And as a bonus, hifi amplifiers tend to deliver significantly more power into a 4-ohm load, which will theoretically increase your system's power 'headroom'.

The relationship between the acoustic output of the subwoofer and the main speakers is not quite as fixed as you may imagine from a passively crossed-over system, either. Since you can physically move the low-frequency speaker around the room, it can be positioned for the best audible result on a trial and error basis.

We found that this technique can produce a dramatic change in the overall sound, and in virtually all cases, we were able to 'tune' the system for a satisfactory result. If you really need a flexible drive signal for the subwoofer though, you could always convert the system to an active setup by adding the suitable amplifier and crossover filter — although this may be difficult to justify for such a modest speaker system.

Priced at $179.50, the RE/SPONSE mini subwoofer is quite an effective and economical way of improving the low-end response of small speaker systems. It's genuinely compact, has a suitably subdued appearance, and is very simple to connect to an existing speaker system. Needless to say, you can check one out for yourself at the nearest Jaycar store (Cat. CS-2500).❖

NEW BOOKS

Continued from page 32

tors, which covers discrete components (diodes, zeners, transistors, triacs), operational amplifiers and digital ICs. Solid state components also pop up in other chapters.

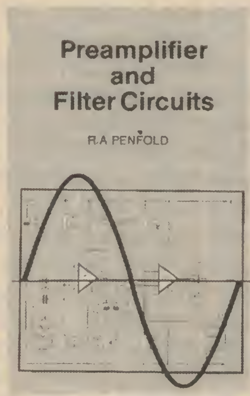
The chapter on connections is brief and covers SCART, RS232, 5-pin DIN connectors as well as a few valve pinouts. The sound chapter includes a basic telephone circuit, tables covering the DTMF frequencies, frequency of musical notes and decibels. There are many audio type circuits and a glossary of audio terms.

Because the book is British, it fits in with the Australian standards. Measurement units are metric and all mains voltage circuits assume 240V 50Hz. This is a most useful book to keep in the workshop.

The review copy came from Butterworth-Heinemann, PO Box 345, North Ryde 2113. It should be available from technical and larger bookshops. (P.P.)

Electronics Australia

BOOKSHOP



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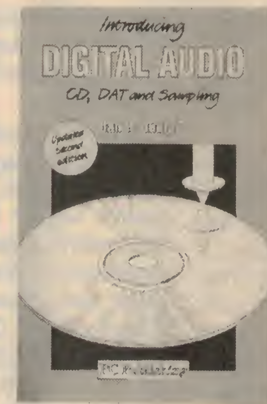

Introducing Digital Audio, CD, Dat and Sampling. - Second Edition:
This book bridges the gap for the technician and enthusiasts who have worked with audio circuits. It includes oversampling methods and bitstream techniques and technical terms.
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Computers and Music - An Introduction:
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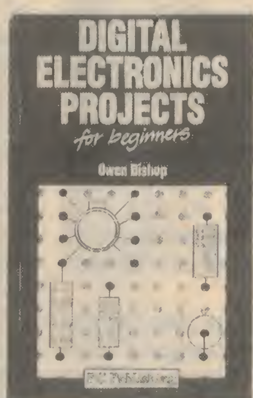
Refers to the powerful capabilities of MIDI and how to exploit it, with no knowledge of electronics or computing. It reviews the latest developments in MIDI covering keyboards, drum machines, sequences, mixers, guitars etc.
CODE: PC 1002 PRICE: $22.95



Digital Electronic Projects for beginners
This book provides simple, yet detailed instruction on practical projects. Covering instrumentation to home security plus circuit diagrams, this reference book also offers 'fun' projects for newcomers to electronic construction.
CODE: PC 1011 PRICE: $19.95

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THE SERVICEMAN

Cracked boards, shorted turns and a customer who tried 'shaving' his VCR!

Over the years, many electronic components have become a lot more reliable than they were, and much less likely to be the cause of servicing faults. But one source of trouble seems to be almost as fertile as it ever was: manufacturing defects, which can take many years to make themselves evident as faults. Our first story this month concerns not one, but two of these defects, which took about 10 years to cause trouble.

This month I'm opening the column with a story from my own bench. It is really a story about two manufacturing defects, even though they have taken many years to show up.

The customer, a lady, brought in her television set safety belted into the back seat of her little sedan car. Heaven alone knows how she got it in there, because I had the devil of a job getting it out. The complaint was that the set had just stopped working. "It was OK last night, but today it just won't go!" On further enquiry, I found that the sound was still OK, but there was no sign of a picture.

The set was a National TC2037, a middle-aged model now around nine or 10 years old. It is based on the M12B chassis, which consists of a single PCB, about 180 x 250mm. The righthand edge of the board is dominated by a large metal heatsink that carries the chopper and line output transistors, and also provides a measure of support for the line output transformer. It was this last feature that really started the wholestory.

When I switched on, I heard the rustle of EHT coming up. This is always a reassuring sign, since it says that the power supply and line output stages are working normally. In this case, the presence of sound also told me that the front end (tuner, IF strip and video detector) and the audio channel were working. Which didn't leave a lot to be investigated...

I lost no time in getting the back off the cabinet. The first check was to see if the picture tube heaters were alight, since failure of the heater voltage is a very common cause of 'no-pix' when everything else is functioning correctly. In this case I could see no glow from the tube neck.

This argument was not entirely convincing though, since I couldn't see the cathodes directly. The tube was of the narrow neck persuasion, and there was very little clearance between the purity/convergence magnet assembly and the rather large and cluttered 'base board' fitted to the tube socket. However, there was certainly no sign of a glow in that area, so I had to assume at least for the present that the heaters weren't working.

Next, I found the heater pins on the base board and looked for a sign of voltage on them. This is always a tricky measurement with a normal multimeter. Where the heater voltage is supplied from the line output stage, as in this set, the supply is very spikey and an 'average reading' meter gives misleading results. Only a 'true RMS' meter can make sense of the voltage on the heater pins.

In this case, my 'ordinary' AC meter showed no sign of any voltage at all. This was evidence enough to tell me that there was no voltage being supplied to the heater. Otherwise, the meter would have shown anything from 2 - 3V up to about 20 volts — depending on its frequency response at 15.625kHz.

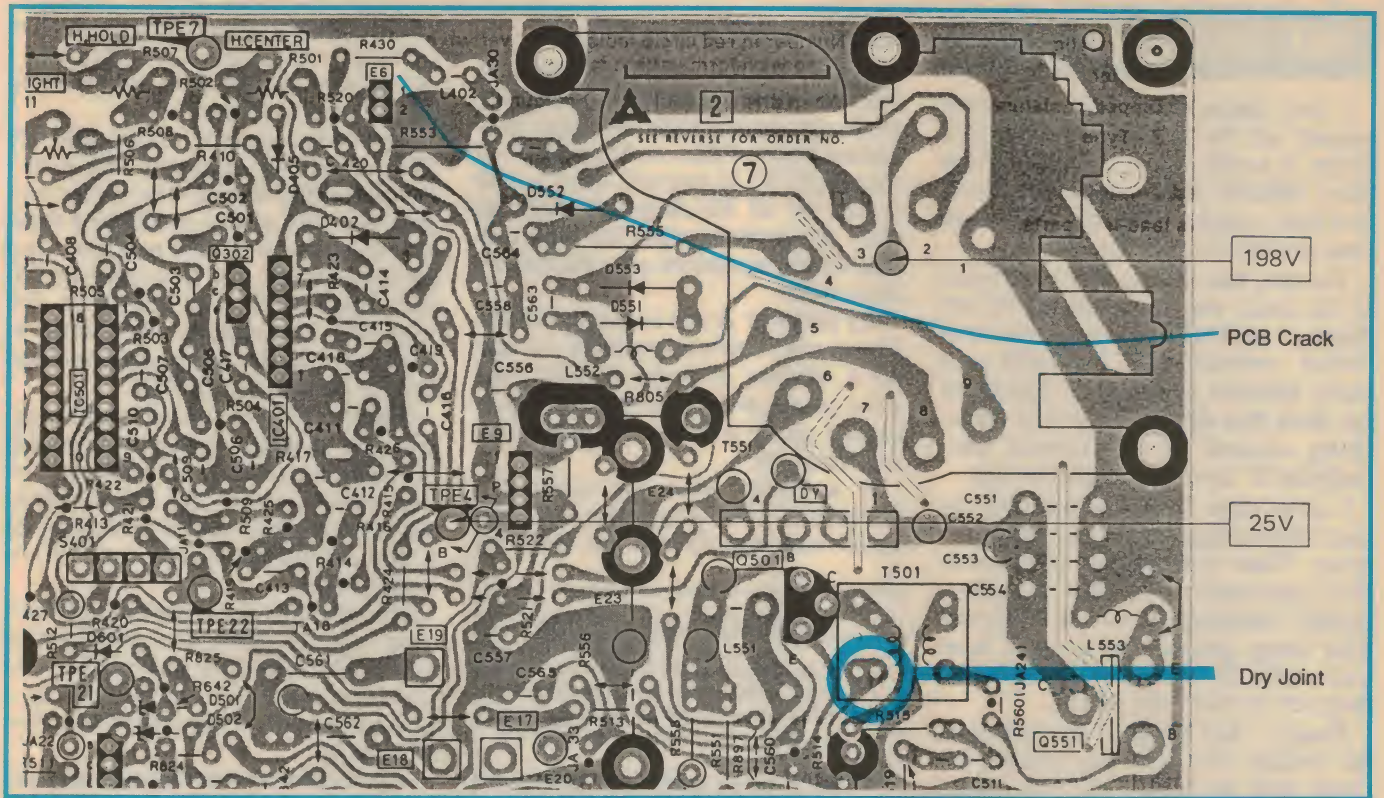
One of the common causes of 'no heater' is a dry joint at either end of the heater supply lead. Such dry joints are probably more common at the base board end, since the tube base becomes quite hot in service due to the proximity of the heated cathodes; it's this repeated heating and cooling that gives rise to broken joints.

However, in this case there was no sign of dry joints at the base board end. So I had to release the main PCB and turn it over, to see about the connections at the other end. But as soon as I inverted the board, I could see the cause of the problem and had no need to search further into the heater string.

Right across one corner of the board, neatly enclosing the secondary pins of the line output transformer, was a large open crack. Among other things, it open circuited the earthy return to the tube heater — hence no glow! It also opened the return from the first anode supply, so that the tube voltages were all wrong, further preventing any sign of a picture.

What did surprise me was that the 12V supply to the signal circuits was not interrupted, or perhaps there was another ground return somewhere else for those circuits. But that didn't matter. What *did* matter was repairing the cracks, and restoring some semblance of normality to the set.

At the edge of the board the crack was wide and very obvious. It narrowed as it passed across the corner of the PCB,



This month, our Serviceman was led a merry dance by a National TC2037 — which suddenly stopped working. It turned out to have a rather spectacular crack in the main PCB, just underneath the horizontal output transformer. Careful examination showed that the crack had been caused by a faulty heatsink bracket, when the set was first manufactured.

and dwindled away to nothing as it approached the rear edge of the board.

My preferred method of repairing cracked PCBs is to align the broken edges and tack them together with solder. If this is successful, it shows that there is no residual strain on the board and reinforcing the repairs with a wire bridge should make a permanent fix.

However, in the process of cracking, this board had twisted — so that the open end of the crack was about 2mm wide and there was no hope of bridging *that* without substantial reinforcement. I felt that the best approach was to try to relieve the strain that was twisting the board, if I could find what was doing it. As it turned out, it wasn't all that hard.

I reasoned that since the line output transformer straddled the crack, any strain relief would involve that component. So I switched on the iron and set about removing the transformer. But before I used the iron, I removed two screws that were holding the top of the transformer to the heatsink.

However, when I looked again at the bottom of the board, the crack had disappeared. Or more correctly, it had shrunk to a very fine line and the 2mm gap that I'd worried about earlier had completely gone. If it were not for the weight of the transformer, a solder bridge would have been all that was necessary to make a sound and permanent joint!

Such a dramatic disappearance of the crack deserved some kind of explanation, so I replaced the two screws that I had just removed. And lo and behold, the crack had opened up again.

As it turned out, the heatsink had been mounted on to the PCB at a slight angle and when the screws were fitted to steady the line output transformer, that item had been pulled over toward the heatsink and in turn applied a strong twisting moment to the board material.

Over the years, the PCB had been resisting the twist, but it had finally given way along the line of least resistance. And of course, it took the copper tracks with it, with the results related at the start of this story.

As far as I can tell, the reason for the sloping heatsink was that the small right-angled projections that formed the mounting feet for the heatsink were not bent to quite the full 90°. When the heatsink was screwed down onto the PCB, it was left canted over at a slight angle. Then when the line output transformer was screwed up to the heatsink, it was the PCB that made up for the mis-alignment, since it was the most flexible component in the system.

To effect a proper repair, I should perhaps have tried to straighten the heatsink mountings. However, I didn't like my chances of getting a true right angle in the relatively heavy aluminium. Alternatively, I could have removed the transformer, then replaced it at a compensating angle after repairing the board.

Instead, I left both the transformer and heatsink as they were, then fitted two longer screws and filled the resulting gap with a piece of hard plastic. The filler was no less than 4mm thick — that's how far out the heatsink was, at the level of the top of the transformer! No wonder the board had been under strain.

Fault number two

This attention got the set up and running again, but not for long. About 10 minutes after I had completed the above repair, the picture flickered, the screen went black, and the speaker gave out what I can only describe as a 'rude raspberry'.

Nothing I could do seemed to alter the symptoms, so I switched off and turned the board up so that I could take a few voltage readings. When I turned the set on again, it came up with picture and sound, but only for a minute or two.

I soon found that I had to leave it turned off for about three minutes before it would restore operation. From this I deduced that it was a heat-sensitive fault, which needed that amount of time to cool off after each failure.

The only clue that I got as to the cause of the fault was once, just as the set failed, I noticed that the picture was folded vertically and the width was much narrower than normal. This made me think that the fault was with something around the horizontal output/yoke/'S' correction capacitor area.

I spent some time going around the line output stage with a can of freezer spray. There were several components that appeared to be heat sensitive, quickly restoring the circuit to normal after being sprayed. But none of them was really to blame, since replacing them left the fault still present.

Finally, I had localised the trouble to the vicinity of a half watt resistor, located hard up against the line driver transformer. This resistor feeds drive pulses to the line output transistor, and it usually kills that device whenever the feed circuit goes high or open. Still, stranger things have been known to happen, so I decided to replace the resistor.

It was while I was trying to find the resistor pigtails on the back of the board that I uncovered the true cause of the trouble. One of the four terminals on the line driver transformer was carrying as neat a dry joint as any I've ever seen.

The crack around the pin was almost microscopic — I needed a powerful glass to see it. The solder was perfectly shaped and shiny. To the naked eye there was absolutely no difference between it and the other three, perfect joints. Yet it was thermally sensitive, going open circuit when heated and restoring the circuit as it cooled down.

Although this job was rather dramatic, it was over and done with in less than an hour. I sometimes wish I could charge on the basis of complexity rather than time. Some jobs, like this one, take little time but call for all kinds of electrical and mechanical skills — which often seem to be undervalued by the average customer.

Mrs 'National', for instance, had not the slightest interest in what was wrong with her TV and couldn't care less about how much trouble it had caused me. All she wanted was for it to be fixed and working again!

Sometimes, I wonder why I bother!

Unusual power problem

Now, from the comfort and convenience of my suburban workshop, we go to the comfortable but less convenient home of P.L., at Albion Park in country NSW. As you will see, P.L. had to call on all his diagnostic skills to solve the problem, when his otherwise reliable test equipment gave misleading information.

My property is not connected to the power grid, and consequently we rely on a mixture of hydro electric and solar power to run our house. This is backed up by a 5kVA 240 volt diesel alternator set.

At weekends, when the washing is being done, even though the power inverter can happily run the load, we usually run the alternator for an hour or two and also a 2.5kW, 12 volt battery charger unit as a base load. (Yes, that's 200-odd amps into a 1000A-H nickel cadmium battery bank).

Anyway, the other weekend the diesel on the alternator sped up as about 4kVA of load suddenly disappeared. The relay reconnected the washing machine to the inverter whilst I went to have a look at what had gone wrong.

Basically, the alternator wasn't producing power. Investigating further revealed that residual voltage was there (about 30 volts AC), and at this point I suspected a broken wire, as the thing had let go so suddenly.

After three hours of testing with the 500 volt bridge megger, I still hadn't found anything wrong. The bridge rectifier was OK, as was the bucking resistor, the windings all had resistance and the brushes were OK, as was the excitation capacitor. It read 15.8uF at 250 volts DC. No windings were down to earth, although the alternator rotor read around 1.5 megs at 500V DC.

Whilst testing the 0.1uF radio suppression capacitor, I started cranking the megger and suddenly the capacitor went short circuit. "Ah ha! Breaking down under load, eh!" I disconnected it and started the diesel, but still no useful output.

I thought that the capacitor may have some obscure fault, so I paralleled it with a 30uF 600V one and suddenly we had about 180V AC. But as soon as a load was put on, it dropped to less than 90 volts AC.

I then did a shorted turns test of all windings, including the alternator and the associated field excitation transformer. At this stage I suspected the transformer, but how do you test something that has no markings, and you don't even know what its internals are made of?

Even when fed with up to six amps, it didn't get hot — just warm. It has resistance, isn't breaking down to earth, even under load, and also doesn't seem to have any shorted turns. Everything tests 100%, but it still won't work!

As a desperation move, I started pulling the transformer apart, carefully. It had 52 turns on the primary, and then about halfway into the secondary, the insulation between turns was stuck. Yep, shorted turns — lots of them.

Why didn't they show up under a load test with the variable AC input? The only explanation I can offer was that the turns concerned were towards the centre of the winding, near the core and therefore the heat generated in them was either dissipated into the core or else would take more than an hour or so to work its way out.

Anyway, the transformer was rewound, along with comments like, "Which World War did this come out of then?" etc...

Another question begs to be answered. Why did it lose its excitation so quickly? Was it due to the fact that the transformer had been failing for a while, and the regulator could handle the dropping volts by increasing the

JUST FOR A LAUGH!

We lay on our back, Magpie and me, enjoying the last of the carton of stubbies and listening to the gentle lapping of the waves against the sides of our little tinnie.

Magpie, as we nicknamed him, was a crafty old gentleman who sometimes helped me with antenna jobs and whose political persuasion was somewhat to the left of Mao Tse Tung. Overnight fishing in the muddy waters of the Logan River in south-east Queensland was a good way to relax and get away from customers.

Talking about customers, earlier in the night an old gentleman and his dog had rowed up alongside us and in a gravelly voice, shouted "Ave yer got any mullet gut? Me bleedin' dog has just ate mine!" The Blue Heeler pup sat looking at us with a silly grin on its face, its stomach bloated and pieces of mullet gut hanging like shoelaces from its mouth. We put our sandwiches back in the tucker box, gave him some bait, and sent him on his way.

"What a beautiful star", I commented, as we lay there gazing at the night sky.

"And it seems to be getting bigger", said Magpie — then "BLOODY HELL!"

We sat bolt upright, as the 40-foot yacht missed us by six inches — its white mast headlight glowing like an evening star...

(Contributed by John Gill, Lowood TV, Lowood, Qld.)

field current, until it went over the magnetising knee curve and couldn't excite any more?

The unit is now working properly again; in fact I can lower the loaded engine speed a few notches, as it's probably getting full field current for the first time in quite a long while.

Thanks, P.L. You know, that story got to me. In a way it made me feel quite humble. Like most of *EA*'s readers, I guess, I've got unlimited power available at the flick of a switch. And if it fails, I berate the supply authority that allowed it to happen — then pace angrily up and down until somebody restores the power.

As P.L.'s story shows us, some people don't get electric power anywhere near as easily as we 'townies' do. P.L. has done us a favour by reminding us how lucky we are, and I hope his power supply never looks back.

Incidentally, in recent weeks I've been having physiotherapy for an injured knee. Part of the treatment is to pedal an exercise bike and this particular model is fitted with an 'ergometer', with a secondary scale calibrated in watts. At first, with a crook knee, I couldn't get my output up to 10 watts, but now I can maintain a steady 50 watts for 10 minutes or more. On one occasion I managed to get it up to 100 watts for a few seconds, but the frantic pedalling needed to reach that figure threatened to overturn the bike.

Just imagine the number of bikes and the number of pedallers that would be needed to generate a megawatt. And we town-dwellers demand hundreds of megawatts each day. We surely get our power cheaply!

Foul-smelling smoke

Now for a story that should, really, go to Neville Williams for his 'When I Think Back' column. However, it IS a servicing story, even if it is about 50 years old. So I'm keeping it here, in The Serviceman.

It comes from C.J., of Crows Nest in Queensland, in the form of a letter commenting on an earlier story in these pages. C.J. writes thus:

Reading the story from L.K. in Daintree, and in particular the section dealing with his 'Hot Box', took my mind back to a not very forgetable day in 1945. At the time I was a Staff Sgt in charge of the radio section of a 7th Div AIF Brigade workshop. Things were somewhat hectic, as we were under a good deal of pressure to ensure that all the 7 Div radios were completely tropic-proofed before our next foray overseas. The said foray proved to be our last, in Borneo.

A brief description of the involvement may be in order. First of all, the ineffectual earlier attempts at tropic-proofing had to be undone, by removing the varnish used and this was achieved by immersion in a solvent.

Then, the radios were to be brought up to — would you believe — 'factory specs', and then ALL (yes ALL!) IF and RF coil cans removed and the sets heated in three-phase ovens to dry out all moisture.

Steady cursing and mumbling always followed the next steps — all switch contacts had to be oiled, all valve bases were dipped in oil and plugged back into their sockets, and all pots had a bituminous 'goo' dobbed on to keep out the tropic-proofing substance. When this had been done, the radios (No 11 sets in this case) were immersed right up to the front panel in 'Chlorinated Rubber (Pink)', and the set was moved around until no more air bubbles were obvious.

Then out of the sink (kitchen variety) and blown off with compressed air; left to drain for a while; dried for four hours in a drying cabinet; air dried for about 12 hours prior to removal of valves; clean rubber out of valve sockets and out of switch contacts; reassemble, readjust and if all went OK, fit back into case.

On THE DAY, six No 11 sets had been placed in the three-phase oven to have the moisture driven out and the temperature control set as required. One bloke was left to ensure that all went as per the book, while the rest of us went for lunch. I was yarning in the Sgt's Mess, before going back to the workshop, when a soldier, the one who was left to ensure that all went well, arrived at a gallop with the biggest bulging eyes I have ever seen, bearing news almost as bad as having lost the war.

He'd gone to the toilet, and on his return found great black billowing clouds of foul-smelling smoke pouring from the oven. The thermostat had stuck, and naturally at maximum! All those old hands who can recall the AWA 'moulded mud' capacitors will be able to envisage the dreadful scene...

The only thing that seemed worse, and indeed it was, was the paper war that then ensued in a vain endeavour to determine the precise cause, and who, if anybody, could be blamed.

Honestly, even though servicing in the old days was much easier than it is now, it did have its pitfalls. Need I add that for the rest of the Tropic

Continued on page 46

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K10140	LOW FUEL INDICATOR For CAR	$11.95
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K10320	VIDEO RF MODULATOR	$17.95
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K10330	RS232 FOR COMMODORE 64	$24.95
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K10340	CAMCORDER MIXER	$29.95
K10345	KARAOKE BOX	$27.95
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K10390	LOW COST QUIZ GAME ADJUDICATOR	$34.95
K10395	MESSAGE RECORDER	$65.95
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ESTABLISHED SINCE 1977

NEW PRODUCTS FOR ASSEMBLY

COMPUTER SERVICE TOOL KIT-10PCS

10 pieces service kit for servicing and repair of computer, printed circuit boards, peripherals and all types of electronic equipments.

- 2 Nutdriver: 3/16" & 1/4"
- 1-Three Claws Parts Retriever
- 1-Assembly Tweezer
- 1-Philips Screwdriver, #0
- 1-Slotted Screwdriver, 1/8"
- 1-Intergrated Circuit Extractor
- 2-Screwdriver Bits Holder
- 1-Poundle Way Bits, Torque: T10, T15
- 1-Poundle Way Bits, Philips: #1, slotted: 3/16"
- 1-Extra Parts Tube

T12451....$32.95

ADAPTOR LEAD

Dual Joystick adaptor. Great for 2 players games. Allow the sharing of one game games port by two joysticks.

P19000.........$24.95

COMPUTER SERVICE TOOL KIT-11PCS

11 pieces service kit for servicing and repair of computer, printed circuit boards, peripherals and all types of electronic equipments.

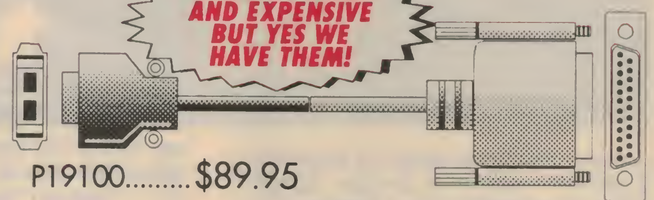
- 1 Nutdriver: 1/4"
- 1 Nutdriver: 3/16"
- 1-Three Claws Parts Retriever/Extractor
- 1 Tweezer
- 1- Philips Screwdriver, #1
- 1- Philips Screwdriver, #0
- 1- FlatScrewdriver, 1/8"
- 1- FlatScrewdriver, 3/16"
- 1- Torque Screwdriver: T10, T15
- 1- IC Extractor
- 1- IC Insertor, 14-16 Pin ICs

T12452....$34.95

2 METRE SCSI II NOTEBOOK CABLE

Connect notebook to SCSI device (HD20M-DB25M).

HARD TO FIND AND EXPENSIVE BUT YES WE HAVE THEM!



P19100.........$89.95

COMPUTER SERVICE TOOL KIT-20PCS

20 pieces service kit for servicing and repair of computer, printed circuit boards, peripherals and all types of electronic equipments.

- Solder Reel
- Solder Sucker
- Heat Sink
- 3pcs soldering aid tools
- 4-1/2" side cutter
- 6" adjustable wrench
- 5" needle nose pliers
- 8" wire cutter
- Reversible Nutdriver 1/4", 3/16"
- Three Claws Parts Retriever/Extractor
- Tweezer
- Reverse Action Tweezers
- Philips Screwdriver, #0
- FlatScrewdriver, 1/8"
- Reversible bit- T10, T15
- IC Extractor
- IC Insertor, 14-16 Pin ICs
- Spare parts tube

T12453....$99.95

"D" CRIMP HOUSING/MALE

	IE NO PINS	1-9	10+
DE09	Cat No P30000	$4.50	$4.00
DA15	Cat No P30002	$4.50	$4.00
DB25	Cat No P30004	$4.50	$4.00
DC37	Cat No P30006	$6.95	$6.50

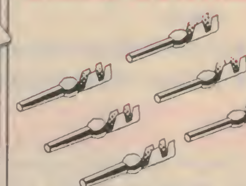
SHELL ONLY - NO PINS

"D" CRIMP HOUSING/FEMALE

	IE NO PINS	1-9	10+
DE09	Cat No P30008	$4.50	4.00
DA15	Cat No P30010	$4.50	$4.00
DB25	Cat No P30012	$4.50	$4.00
DC37	Cat No P30014	$6.95	$6.50

SHELL ONLY - NO PINS

CRIMP CONTACT



Part	Cat No.	Price
Male	P20000	$1.95
Female	P20001	$1.95

Per pack of 10 pins

You need the tools below for these crimp pins

WE HAVE THE LATEST RANGE & BEST PRICES IN TOWN!!

NEW TOOL

"D" CONTACT CRIMPER

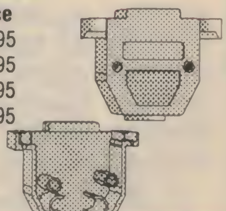
For use with crimp contacts P20000 & P20001

T13002...$49.95
You need this for the crimp shells

CRIMP SHELLS

Shells ready to be assembled. Screws and plates supplied in pack.

Part	Cat No.	Price
DB9	P10882	$2.95
DB15	P10892	$2.95
DB25	P10902	$2.95
DB37	P10912	$2.95

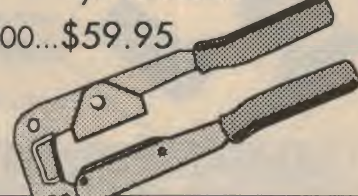


NEW TOOL

RIBBON CABLE CRIMP HAND TOOL

For use with ID/DSR/EC style connectors

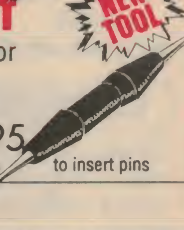
T13000...$59.95



"D" CONTACT

NEW TOOL

Pin Insertor/or Extractor
For use with crimp contacts and housing.



T13003.........$7.95
You need this for the crimp shells to insert pins

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SABRE1

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HAVE A ROMP THROUGH OUR CD ROM AND SOUND CARD PRODUCT RANGE...

CREATIVE

Everything you will ever need to make your computer scream, explode or sing....

SOUND BLASTER CD16 DISCOVERY PACK

Combine the Sound Blaster 16 Card with CR563B - Creative Double Speed PhotoCD compatible, Multi Session CD-ROM Drive for maximum effects.

- Upgradable to Advanced Signal Processing Technology and Wave Blaster.
- Includes Stereo Speakers and joystick.
- CD Titles - Children's Screen Singer, The New Grolier Encylopedia, Return to Zork, Aldus PhotoStyler SE, Aldus Gallery Effects Vol. 1, Altamira Compose SE, Kai's Power Tools & HSC Digital Morph.

Includes bonus disks - Lemmings & Indy 500 on 3.5" floppy.

Cat No. X17208 **$629.00**

GAME BLASTER CD16

Same Hardware bundle as Discovery Pack but packaged with the following CD Titles:

- CD Titles: The New Grolier Encylopedia, Iron Helix, Rebel Assault, Return to Zork, Sim City 2000 , F117A, Railway Tycoon, Civilisation & Silent Service.
- Bonus - Lemmings & Indy 500 on 3.5" floppy.

Cat No. X17206 **$799.00**

EDUTAINMENT CD16

Same Hardware bundle as Discovery Pack but packaged with the following CD Titles:

- Microphone & Voice Assist Software.
- CD Titles: Adventure CD, Allie's Playhouse, Children's Screen Singer, 3D Dinosaur Adventure, Links, The New Grolier Encylopedia, Rebel Assault, Speed, Aldus Photostyler SE, Aldus Gallery Effects Vol. 1, Altamira Composer SE, Kai's Power Tools & HSC Digital Morph.
- Bonus - Lemmings & Indy 500 on 3.5" floppy.

Cat No. X17210 **$879.00**

NEC MultiSpin 3xi - Internal

Triple Speed, PhotoCD Compatible, Multi Session CD-ROM drive. Cat No. C11930 **$899**

- Data transfer - 450Kb/sec, access time - 195ms
- 256Kb cache memory
- Include SCSI-1/SCSI-2 selectable switch, cables, mounting hardware and disc cartridge

RECHARGEABLE BATTERY

Rechargeable 8.4V Square Type Nicad Battery. Use it in conjunction with our Universal Battery Charger. Cat No. S15023

Charging: 14 hours at 10mA.

	1-9	10+
	$14.95	$13.95

JOYSTICK DUAL CABLE

Joystick dual cable for 2 joysticks on one port connector.

Cat No. P19000......**$24.95**

NEW 4 MEG 3.5" DRIVE 2.8MBYTE FORMATTED

Model JU-259AP is a extra high-density 3.5-inch double-sided flexible disk drive wih the capacity of 4 MBytes (unformatted). JU-259AP has the following features:

- Perpendicular recording (barium ferrite media) is applied to realize very high recording density of 34.9 Kbpi.
- Read-write compatibility with 1MB/2MB diskette
- Pre-erase head brings excellent overwrite characteristics.
- Compact 1-inch height dimension

Cat No. C11916 **$189.00**

CD ROM DRIVECR562B

Works with all Sound Cards except (Creative labs) Sound Blaster

Cat No. C11908 **$289**

- Audio Cable & Drive Cable supplied.
- Comes with Software Drivers.

LAMINATOR

Laminate your postcards size photos and save them from wear and tear.

$89.00

Cat No. A91100

COMPUTER CABLES

Longer Lengths now available. Pre-made Ethernet Cables. High quality cables - BNC 50 ohm 30m M/M Net/Cable.

Cat No.P37730 30M..............**$59.95**

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Laminate Sheets come in 24 sheets

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Y11128	25MHZ	$9.95
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CDROMS

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WINDOWS BASED STUDENT SOFTWARE

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Borland Pascal V7	$220	
Corel Draw V4 (CD ROM)		$619
Excel 5.0	$220	$479
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Laplink Pro V5.0		$189
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Lotus Freelance V4	$179	$599
Lotus Smart V2.1		$790
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MS Windows 3.11	$149	$199
MS Powerpoint	$230	$490
MS Project V4		$749
MS Publisher V2	$110	$149
Norton Back-up V3	$89	$95
Norton Desktop V3		$229
Norton Utilities 8	$150	$229
Visual Basics	$125	$320
New MS Works 3	$110	$175
MS Office		$720
MS Office Pro		$795
PageMaker Ver. 5	$460	$1188
Quicken Ver 3	$65	$65
Quattro Pro V5	$125	$195
WordPerfect 6.0 WIN	$185	$530
Word for Windows 6	$226	$520

NEW

ON DEMO IN OUR CITY STORE

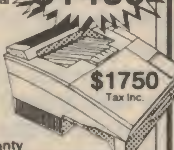
EPSON EPL-5600

600DPI x 600 DPI Personal Laser Page Printer. Check out the specs! 6 PPM!

- 600 x 600 dpi resolution
- SPARClite RISC processor
- High speed bidirectional parallel, serial ports standard
- 45 scalable fonts
- Built-in printer sharing (up to 4 users)
- 2 Mbyte memory. exp to 64 Mbytes
- EPA Energy Start Compliant

12 months on-site warranty

Tax Ex **$1469**



$1750 Tax Inc.

EPSON PRINTERS

LQ-100 80 Column, 24 pin Dot Matrix, 200 CPS Draft, 72 LQ

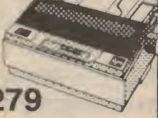
Just **$359**

NEW

EPSON LX-300

Narrow carriage, colour upgradable, near letter quality personal high speed dot matrix printer.

- 9-Pin impact dot matrix
- 264 cps draft (12 cpi)
- 80 column
- Parallel, serial ports standard
- 3 standard fonts
- SmartPark
- Detachable push /pull tractor friction feed



$279

Colour Option......$99.00

FLOPPY DRIVES

1.44 Mb 3½" F.D.D.	$79.00
1.2 Mb 5¼" F.D.D.	$89.00

486DX2-66 MULTIMEDIA SYSTEM

LATEST TECHNOLOGY - DX4-100 UPGRADABLE MOTHERBOARD SUPPLIED

This is a true 486 machine, not a 486SX machine sold by "The Big Stores". What you get from our system is the latest technology and the most complete bundle you will ever find. Don't settle for anything less than fast graphics & superb sound system! 486DX4-100 upgradable motherboard fitted.

$2795 INC. TAX

$2400 EX. TAX

HARDWARE CONFIGURATION:

- VESA LOCAL BUS components, including: I/O Card, Video Card & Motherboard.
- 4MB of SIMM RAM exp to 64MB
- 255MB Hard Disk Drive
- 1.44 Floppy Disk Drive
- 14" Supa VGA Monitor-1024 x 768 resolution
- The popular Microsoft Ergonomic Mouse
- 101 Enchanced Keyboard

CPU Options with above configuration:

486DX2-50............	$2699 Tax Inc
	$2350 Tax Ex
486DX-40............	$2599 Tax Inc
	$2300 Tax Ex

MULTIMEDIA ENTERTAINMENT:

- Internal *Double Speed* Photo CD, CD ROM drive which will play the latest video software
- Sound Blaster 16 sound card
- Creative SBS-30 Speakers
- Joystick for those shot-em-up games

WARNING: DON'T BUY OLD TECHNOLOGY. COME TO RIE FOR THE LATEST DX2-66. WE ALWAYS HAVE THE LATEST PRODUCTS

TO GET YOU UP AND RUNNING:

- DOS 6.2 & Windows 3.11 all preinstalled
- Microsoft Works for Windows*

UPGRADABILITY:

- Pentium P24T upgradable motherboard
- Augat Zero force socket set your system up for future DX4-100MHZ or Pentium CPU upgrade.

CD BONUS EXTRAS!!

Microsoft Bookshelf - A CD-ROM reference library to the World Almanac, Hammond Atlas, The American Heritage Dictionary and many others.

Phonedisc - The latest in Australian Directory Assistance. Allow you to find virtually any business numbers in Australia, including Fax Numbers

*FREE MS WORKS FOR WINDOWS preinstalled, $1,000 of value! Easy to learn with text & illustrated in-built tutorial. Great way to teach yourself easy functional Spreadsheets, Database, Wordprocessing and Mailing Lists. Learn at your own pace in the comfort of your own home!

4 YEARS PARTS & LABOUR WARRANTY

ATTENTION!!

This system is designed to cater for HIGH SPEED GRAPHICS and CD ROM, especially the latest Video Software. Buying anything less will mean that you will miss out on the latest Video on PC revolution.

DOS 6.2 UPGRADE 3.5" ONLY $59.00

EPSON STYLUS COLOUR INKJET

NEW

Affordable colour at 720 dpi!

Features include:

- 720dpi resolution (with special paper).
- 64 nozzzle (black) and 3x16 (colour) nozzle ink jet dot matrix.
- Parallel & Apple interface serial ports with auto-switching
- 240 cps LQ (12 cpi)
- 100 sheet paper cassette
- 80 coiumns
- 9 standard fonts
- ESC/P 2 with scalable font

12 months on-site warranty

$1375 Tax Inc.

Tax Ex. **$1240**

720DPI paper..........$49.95

360DPI paper..........$45.95

PACKETS OF 200

PRINTED COLOUR SAMPLES AVAILABLE- JUST SEND US YOUR BUSINESS CARD!

NEW MONITOR RANGE:

All this superb monitors on display at all Stores

- 14" Super VGA 1024 x 768 (0.28" Dot Pitch).....$379
- 14" Non-interlaced 1024 x 768 (0.28" Dot pitch)..........$429
- 15" XGA Analogue 1280 x 1024..........$595
- 15" XGA Digital 1280 x 1024..........$729
- 17" MPRII Digital..........$1395

	1-9	25+	100+
20 PIN DIL			
44256-70	$12.95	$12.50	$11.00
SIMM			
1M x 9-60	$85	$83	$79
1M x 9-70	$72	$69	$65
4M x 3-70	$279	$269	$259
4M x 9-70	$299	$289	$279
32Kx8 20nS Static RAM for Cache Upgrades	$10.95	$9.95	$9.50
72 PIN SIMM FOR PENTIUM M.B			
1M X 9-70	$99	$87	$85
4M X 9-70	$299	$295	$289
8M X 9-70	$598	$585	$578
16M X 9-70	$1179	$1159	$1129

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96M INTERNAL 9600BAUD..........	$399
96M EXTERNAL 9600BAUD..........	$499
144M INTERNAL 14400BAUD......	$449
144M EXTERNAL 14400BAUD......	$549
144FM INTERNAL 14400BAUD......	$499
144FM EXTERNAL 14400BAUD......	$599
MAESTRO 2400XR..........	$299
MAESTRO 2400ZXR..........	$399
MAESTRO 9600XR..........	$399

SOUNDBLASTER CARDS

NEW Sound Blaster Pro *VALUE EDITION With Lemmings & Indy 500*..........	*$160*
Sound Blaster Deluxe..........	$90
Sound Blaster 16 bit..........	$189
ASP Chip..........	$99
Video Blaster SE..........	$529
Video Blaster FS200..........	$649
Game Blaster CD16 Pack 7 CD Titles..........	$799
TV CODER..........	$290
16 bit Discovery Pack CD16..........	$629
8bit Discovery Pack CD8 .... *(With Zork)*..........	$549 / $599

HARD DRIVES *VOICE COIL IDE HD*

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212M	16ms	$369	$305
260M	16ms	$389	$320
270M	16ms	$412	$340
345M	12ms	$419	$345
420M	12ms	$485	$399
540M	12ms	$599	$495
810M	12ms	$1029	$850
SCSI DRIVE			
1 GByte SCSI HD		$1395	$1153
1.7 GByte SCSI HD		$1995	$1645
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Drive Mechanism		$395	$310
Cartridge105MB		$149	$118

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386SX-40* LM47..........	$139
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386DX-40* 128K Internal Cache LM58...	$209
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486SX-25 OK Cache. *Upgradeable CPU socket*..........	$279
486SX-25 256K Cache. *Uupgradeable CPU socket and 3 Local Bus Slot*..........	$339
486SX-33 256K Cache. *Upgradeable CPU socket & 3 Local Bus Slots*..........	$379
486DX-33 256K Cache. *Upgradeable CPU socket & 3 Local Bus Slots*..........	$599
486DX-40* 256K Cache L.B..........	$525
486DX2-50* 256K Cache L.B..........	$579
486DX-50* 256K Cache L.B..........	$899
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NEW PENTIUM 60MHz/512 Cache PCI/ISA..........	$1899
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*AMD CPU. Without Asterisk- INTEL CPU

VERBATIM DATALIFE 3.5"HD DISKS

PLASTIC BOXES

Description	1-9	10+
3½ DS/DD	$18.95	$17.95
3½ DS/HD	$24.95	$23.95
5¼ DS/DD	$13.95	$12.95
5¼ DS/HD	$18.95	$17.95

CARDBOARD BOXES

Description	1-9	10+
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3½ DS/HD	$23.95	$22.95
5¼ DS/DD	$12.95	$11.95
5¼ DS/HD	$17.95	$16.95

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VL-300 VL-BUS SCSI/IDE & MULTI-I/O HOST ADAPTOR..........	$299
ADAPTEC* 1522A SCSI CONT 16BIT ISA..........	$225
ADAPTEC* 1542CF FAST SCSI HOST ADAPTOR..........	$499
EZI SCSI DOS Manager *(Required to run*)*..........	$125

CD ROM DRIVES

562B CD ROM DRIVE DOUBLE SPEED SONY works with all other sound cards except Sound Blaster.......... **$269**

563B CD ROM DRIVE DOUBLE SPEED works with all Sound Blaster Cards.......... **$289**

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DOS 6.2 ....*$89.00

M.S WORKS *$99.00

DOS 6.2 & Windows 3.11 ....*$149.00

DOS 6.2 & Windows for Workgroups *$179.00

When purchased with a system

PENTIUM *60MHz* External 512K Cache **$3395** Tax Ex. $2795

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Construction project:

The IMP - 2

In this second part of our series on the IMP loudspeaker testing system, we'll cover the circuitry used in the module and discuss its operation.

by ROB EVANS

Those who read our first installment on the IMP system should now be aware of both its principle of operation and its impressive range of features. If you've already purchased the software, you may have noticed that most of its post-processing operations will happily function without the actual IMP module connected to the PC. By using the sample files supplied on the disk, you will soon get the feel of how the program operates and hopefully then know what sort of results to expect from your own IMP module.

The IMP hardware

Fig.5 shows a block diagram of the IMP module's circuitry, with only the main signal, control, data and address paths included in the interests of clarity.

As you can see from the diagram, analog signals from the probe or mic inputs are passed to the heart of the IMP module, a 12-bit analog-to-digital (A/D) converter via the input selector and low- pass (LP) filter stages. Both the selector and filter circuits operate under software control, allowing the PC to select the appropriate input signal and filter cut-off frequency for different analysis modes.

The A/D converter then samples the incoming signal at a rate of 1.92kHz or 61.4kHz (again, as selected by the PC), and stores the results in an 8K x eight-bit static RAM (SRAM) as two eight-bit words per conversion — a total of 4096 (4k) samples. Note that since each 12-bit conversion occupies a pair of eight-bit RAM locations (a total of 16 bits), four of the bits in one location are effectively not used.

In practice, the IMP module begins sampling the input signal as soon as a test pulse has been produced by the digital one-shot (as also shown in Fig.5), and will store around two seconds of data when the sampling rate is set to 1.92kHz, or about 66 milliseconds of audio for the 61.4kHz rate. The results can then be read back to the PC for processing by the IMP software.

In this read mode, the SRAM's address counter is placed under software (rather than internal hardware) control, and each eight-bit word passed to the printer port socket via a multiplexer, as two four-bit 'nibbles'.

Four of the lines normally used to detect printer status ('paper end', 'busy', and so on) are used here, so that the IMP module and software can communicate via a PC's standard parallel printer port and cable.

All stages within the module operate under the command of the 'timing and control' block, which incorporates a 2.4576MHz crystal oscillator and associated divider stages, timing circuits for the A/D converter and SRAM operations, and buffering for the PC's control lines.

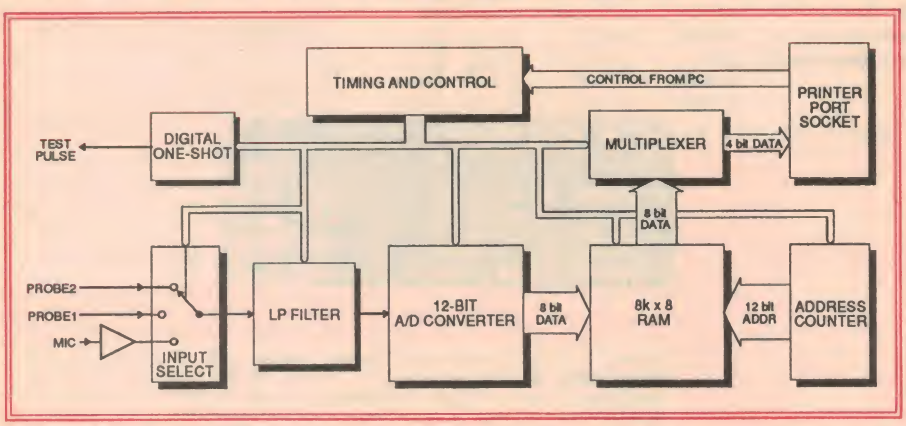


Fig.5: A block diagram of the IMP module's circuitry. The 12-bit data from the A/D converter is stored as two 8-bit words in an 8K SRAM, then ultimately passed to the PC as a series of 4-bit 'nibbles' under the control of the multiplexer stage.

Circuit description

While the schematic diagrams for the IMP module may seem reasonably complex at first glance, the circuitry can be divided into several sections that perform quite well defined tasks.

Starting at the control lines from the PC which appear at pins 2, 3 and 5 through to 9 of the printer port socket SKT1, you can see that each line has a 1k pull-up resistor (R29 to R35) and passes to an inverting Schmitt-type buffer (IC11b, c, d and IC12a, d, e, f). The control lines at pins 1, 5 and 9 have additional 1nF bypass capacitors (C27, C28 and C29), to attenuate any high-frequency interference picked up in the interconnecting cable.

The PS, M/P and SLOW control lines (at the outputs of IC12a, IC12f and IC12e, respectively) are of immediate interest, as they are used to control the action of the analog input selector, IC16. Turning to this part of the circuit, you can see that the selector is based on a 74HC4053 analog multiplexer, which effectively has three changeover switches, A, B, and C; these change state in sympathy with the digital control lines at pins 11, 10 and 9 respectively.

Here, the PS (probe select) control line uses switch C to choose between the Probe 1 (SKT3) and Probe 2 (SKT4) inputs, which are coupled to IC16 via isolating capacitors C22 and C23, and protection resistors R26 and R27. Note that the inputs are terminated by R1 and R2, and the switch inputs biased to a 2V reference by R3 and R4 — R25 and R28 are 'sacrificial' resistors to protect against reversed polarity input connections (more of this later).

The output of switch C then passes to the probe level control RV1, which in

turn feeds one input (B0) of the B switch, the mic/probe selector (M/P). The remaining B input (B1) is ultimately connected to the mic input, as you would expect.

The microphone signal at SKT5 is passed to a preamp stage based on IC17b, via biasing resistors R5 and R7 (R5 provides 'phantom power' for suitable mics) and coupling capacitor C25. The preamp gain is set to 22 by the combination of R8, R9 and bypass capacitor C20, and connects to IC16 via the mic level control RV2 and coupling/biasing components C21 and R6.

Next, the output from switch B (as selected by the M/P line) is passed to amplifier stage IC17a, which is set to a gain of 22 by R22 and R21, and on to a three-pole LP filter based on components R11 to R18, C12 to C16, and IC17d.

In this stage, switch A of IC16 (controlled by the SLOW line) selects between two filter network 'arms', in order to change the anti-aliasing filter's cut-off frequency to suit the current sampling rate. The upper arm's components set the filter to approximately 700Hz for the 1.92kHz (SLOW) sampling rate, while the lower arm sets the cut-off at around 22kHz for the 61.4kHz rate. Also, the filter's gain is set to 2 by R13 and R16.

The selected and filtered audio at IC17d (A/D IN) is then passed to the positive input (IN+) of the A/D converter (IC18) at pin 3. Since the MAX190 converter features a 'pseudo-differential' input where a negative input (IN-) is available at pin 4, this is also connected to the 2V reference voltage used to bias the earlier analog stages.

This reference or bias voltage is in fact derived from the A/D's own internal 4V reference at pin 5, which is bypassed by C9 and C7, then applied to a voltage divider formed by R19 and R20 — this is shown near the probe level control RV1 in the schematic. The resulting 2V level is then buffered by IC17c, and ultimately used to bias the analog stages to the centre of the conversion range. By the way, the MAX190 is used in its bipolar input mode (BIP, pin 8 is high), so that when there is no *differential* input voltage (IN+ is at 2V) the conversion result is zero.

After each sample occurs, the corresponding 12-bit data is then passed to the 6264 SRAM (IC19) via the data bus as two sequential eight-bit words — the least significant (LS) byte first, then the most significant (MS) byte. These are stored in two memory loca-

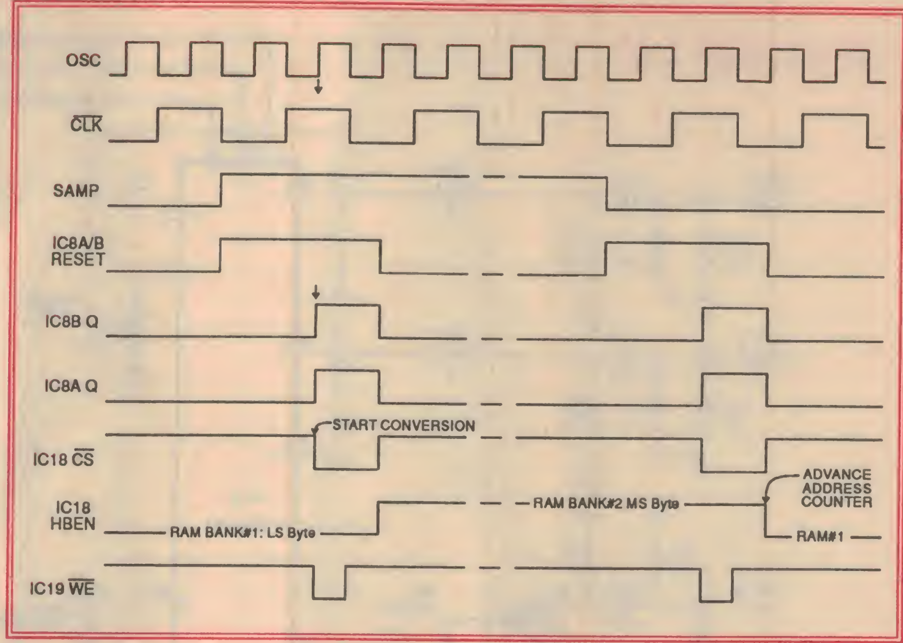


Fig.6: The timing waveforms for key parts of the control circuit.

tions as selected by the A1 address line (pin 9), while the RAM moves through its overall address range in sympathy with the 12-stage address counter IC15, which advances as each sample occurs — more on the module's read/write timing later.

Once a full range of samples has been gathered, the RAM data can be read back to the PC via the quad multiplexer IC1 and the printer port connector SKT1. In this case, the eight-bit data at each RAM location is passed via the data bus to the multiplexer's eight inputs, where as before, the memory's address is stepped through by both the address counter and the action of the RAM's A1 line.

Each eight-bit word is then 'sliced' into two four-bit nibbles under the control of IC1's A/B select line (pin 1), which in turn is driven by the PC's software via pin 3 of SKT1 and inverting buffer IC11d. IC1 passes the resulting data nibbles directly to the output socket (SKT1) at pins 10 through to 13, where they are read and stored by the PC.

Other than reading data from the IMP module, the PC must also instigate a sampling run and detect that the procedure is under way. This is achieved by the latching stage based on D flipflops IC14a and IC14b, which is 'triggered' via the PC control line at pin 9 of SKT1, and reports its state to the PC at pin 15 of SKT1.

Here, the PC starts a run by pulling pin 9 low, which drives IC14a's clock input high through the inverting action of IC12d. IC14a then transfers the high at its D input to the Q output ('GO'), which in turn enables IC14b, since its reset line is now high. Both flipflops start in a reset state, by the way.

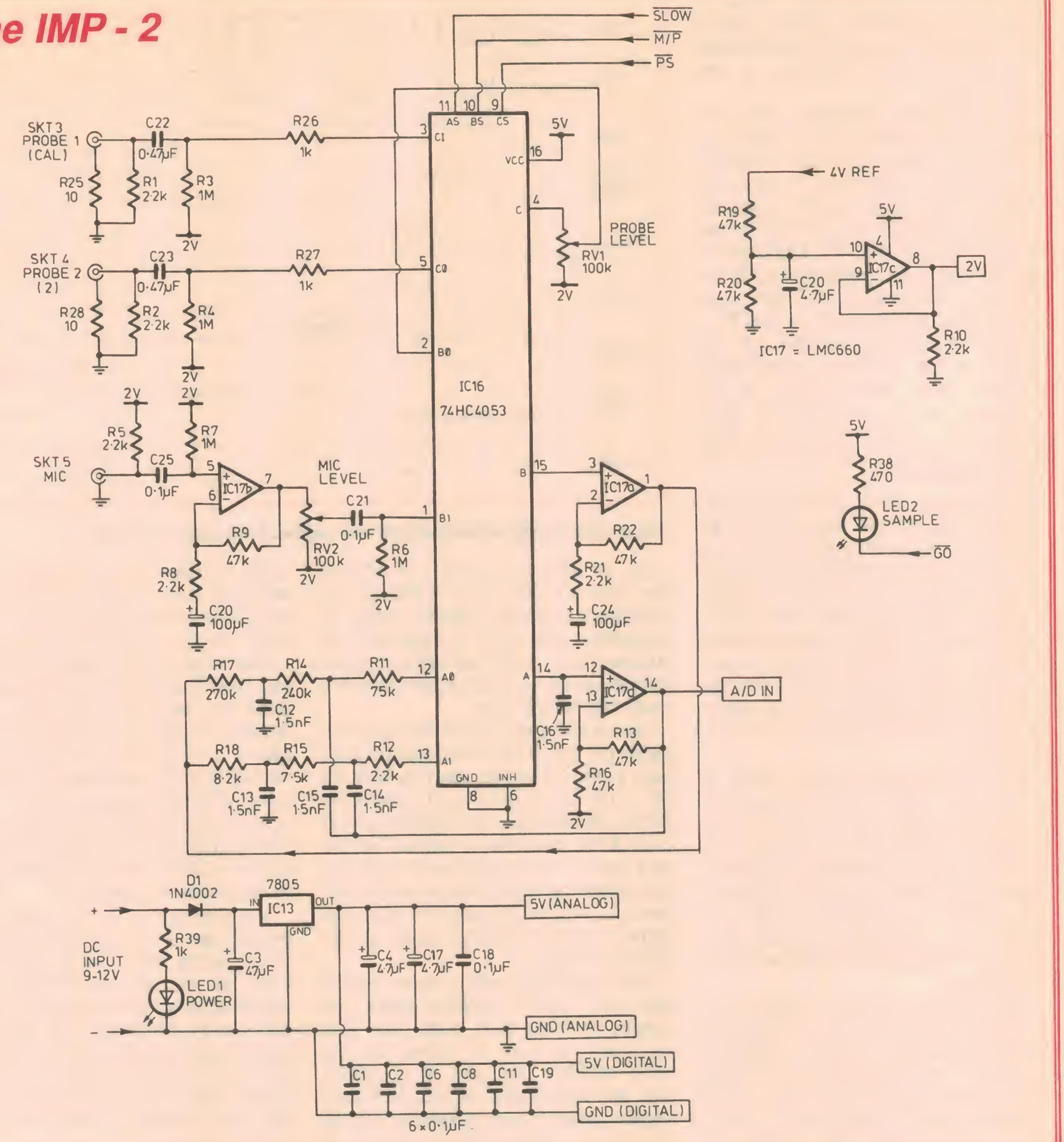
The flipflops will remain in this current condition (with the GO output high) until the end of the sampling period, when the address counter's Q12 line (pin 1 of IC15) falls. This edge is inverted by IC12c and applied to the clock input of IC4b, causing it to set. The low at its Q-bar output then resets IC14a, which immediately resets IC14b as the GO line falls — thus the flipflops return to their initial reset state.

In practice, the GO line plays an important part in the overall timing and control of the IMP module. Firstly, it informs the PC that the module is busy sampling (as already mentioned), so that data can be retrieved at the end of this period; and secondly, both GO and GO-bar (pin 6 of IC14a) signals are used to enable and inhibit a number of key signals and functions within the module's circuitry itself.

As you would expect though, the heart of the IMP module's timing system is its actual clock circuit. This is formed by a crystal oscillator (IC2c) driving a series of dividers (IC3b, IC4b and IC4a), and an output selector based on another multiplexer, IC5.

In more detail, the master oscillator is quite a conventional circuit based around IC2c and using a 2.4576MHz crystal (XTAL1). The resulting clock signal is buffered by inverting gate IC2d. The output is then passed to both the decade counter IC3b (at the CKA input) and other sections of the circuit,

The IMP - 2



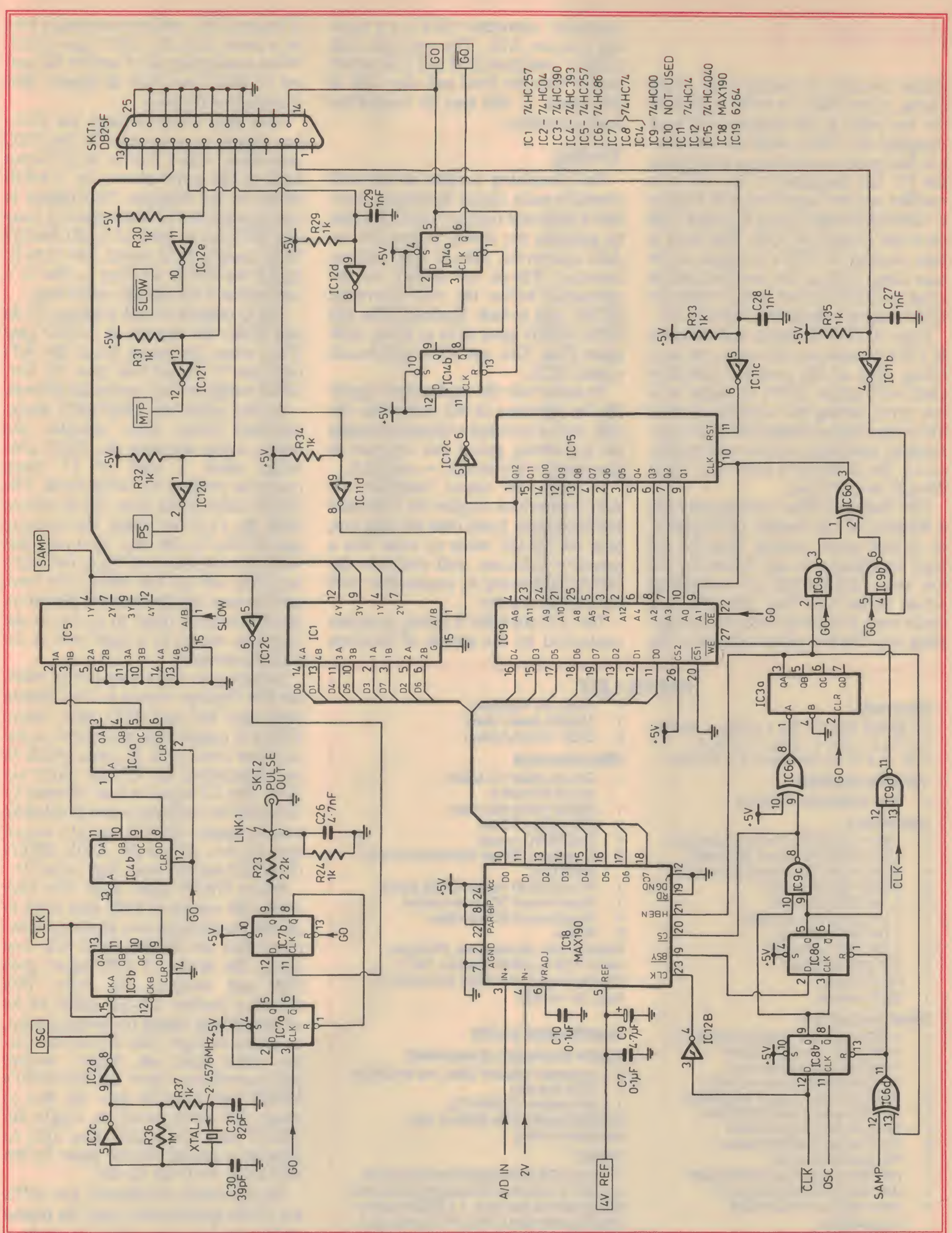
The schematic for the module's analog circuitry. The input signal and anti-aliasing filter slope are selected by IC16, which is used as a three-pole two position analog switch.

as the OSC signal. This signal is subsequently divided by two in the first stage of IC3b, resulting in a 1.23MHz signal at the QA output, which is then tapped off as the CLK-bar signal and also fed to the counter's divide-by-five section at the CKB input.

The output (QD) from *this* section of the counter (at around 245kHz) is then passed to the input of the following binary counter IC4b, where it is divided by both four and 16 — these appear at the QB (61.44kHz) and the QD (15.36kHz) outputs, respectively.

IC4b's QD output is then divided a further eight times by IC4a (1.92kHz), and the output passed to the 1A input of multiplexer IC5. Thus we have our two sampling clocks presented at the '1' switch of IC5 — since IC4b's QB output is directly connected to the multiplexer's 1B input. Hence the A/B control (pin 1) allows us to pass either clock on demand. So depending upon the state of the SLOW control line as set by the PC, IC5's 1Y output (pin 4) will pass the appropriate clock signal — 'slow' is 1.92kHz, as you would expect. This then feeds the remaining circuit as the 'SAMP' signal, and also passes to the clock input of D-type flipflop IC7b via inverting gate IC12c.

IC17a and IC17b combine to form a



The digital sections of the IMP circuit. The heart of the system is a MAX190 12-bit A/D converter (IC18) and a 6264 8K x 8-bit static RAM (IC19). IC15 is the RAM address counter.

digital one-shot (or single-pulse gating circuit, if you like), in order to produce the test pulse at the beginning of each sampling run. Here, when the GO control line goes to a high logic level (once the PC has instigated a run), IC7a is enabled, and the high level at its D input is clocked through to the Q output, and on to the D input of IC7b. This level is then clocked to IC7b's Q output at the next rising edge of the inverted sample clock (at IC17b's clock input), while the Q-bar output immediately resets IC17a.

Since IC17a's Q output, and therefore IC17b's D input are now low, the next rising edge of the inverted sampling clock will return IC7b's Q output to a low level, ending the test pulse period. The output then remains low, since subsequent sampling clocks will merely clock the D input's now low level through to the output.

The final test pulse consequently has a duration of one sample clock period, or in real terms, around 16us for the high sampling rate and 520us for the low rate. And through the controlling action of the GO line, this will only occur once at the beginning of the sampling run. The test pulse is passed to the 'pulse out' connector (SKT2) via limiting resistor R23. The optional link (LNK1) introduces R24 and C26, which reduce both the level and slew rate of the output — this may be needed for some amplifiers.

Timing

The remaining section of the IMP module's main circuit involves a number of gates and flipflops which are used to generate the timing pulses for the A/D converter, SRAM and address counter. These are shown in the schematic below the A/D converter (IC18), and include flipflops IC8a and IC8b, NAND gates IC9a to IC9d, XOR gates IC6a, IC6c and IC6d, and decade counter IC3a.

To assist with the explanation regarding the operation of this part of the circuit, we've included a diagram showing the key timing pulses that are used or generated in that section — see Fig.6.

In short, the circuit instigates the A/D conversions, toggles the low-order and high-order bytes onto the data bus, tells the SRAM when to write into a memory location, and controls the SRAM addressing in conjunction with the address counter.

The A/D converter's timing is mainly controlled by the action of flipflops IC8a and IC8b, which are normally held in a reset state by XOR gate IC6d. When a sampling clock arrives the output of IC6d goes high as shown, thus enabling the flipflops.

IC8b then clocks through the CLK-bar signal in response to the OSC waveform, which forces its Q output high at the point shown by a small arrow on the diagram. This output in turn clocks the A/D converter's busy line (BSY-bar at pin 9 of IC18) through IC8a, causing its Q output (pin 5) to be high if the A/D is *not* busy — that is, a conversion is not already under way.

The Q outputs of both flipflops (IC8a and IC8b) are applied to NAND gate IC9c, where its output forces the A/D converter's CS-bar line (pin 20) low, which instigates the conversion process.

At this point the MAX190's track-and-hold input stage samples the analog input, and then the chip's converter takes a total of 13 clock cycles to produce its 12-bit result. The chip's clock input (pin 23) is driven from the CLK-bar signal via inverting gate IC12b, by the way. Also note that while it's not shown in Fig.6, the A/D's busy line will go low during this time, and the *new* sample result is placed on the data outputs (pins 10 to 18) as the busy line returns to a high level at the end of conversion.

Returning to the timing circuit itself, the two flipflops remain in their current state until the next OSC pulse, where IC8b's Q output falls in response to the now-low level at its D input, which in turn terminates the CS-bar pulse via IC9c. The CS signal is then inverted by IC6c and the resulting pulses divided by two in counter IC3a — its QA output (pin 3) then drives the A/D's HBEN (high byte enable) input high at pin 21.

When HBEN goes high this also causes the output of XOR gate IC6d to go low, resetting the two flipflops. However when the SAMP signal falls low again, the output of IC6d again goes high and removes the reset. This allows a further CS-bar pulse to be generated later during the timing period, as shown in Fig.6. But this second CS-bar pulse does not trigger another A/D conversion, since the MAX190's HBEN line must be low for this to occur; it's used purely to toggle the HBEN line low again, and also to generate a second WE-bar pulse for the SRAM, as we'll see shortly.

As previously mentioned, the A/D's the 12-bit sample result must be placed on the data bus as *two* eight-bit words, a most- significant (MS) byte and a least-significant (LS) byte. This is under the

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Resistors

(All 0.25W 1%): 5 x 1M, 1 x 270k, 1 x 240k, 1 x 75k, 6 x 47k, 1 x 8.2k, 1 x 7.5k, 8 x 2.2k, 12 x 1k, 1 x 470 ohms, 2 x 10 ohms

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2 100k single-gang log pots

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2 100uF 16VW PC-mount electrolytics
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4 4.7uF 16VW PC-mount electrolytics
2 0.47uF MKT polyester
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1 74HC393 dual 4-bit counter
1 74HC390 dual decade counter
2 74HC257 quad 2-input multiplexer
1 74HC86 quad 2-input XOR gate
3 74HC74 dual D-type flipflop
2 74HC14 hex Schmitt inverter
1 74HC04 hex inverter
1 74HC00 quad 2-input NAND gate
1 MAX190 12-bit A/D converter
1 6264-15 8K x 8 static RAM, or equivalent
1 LMC660 or TLC274 quad CMOS op-amp
1 7805 +5V regulator
1 1N4002 power diode
2 LEDs, red and green

Miscellaneous

1 Double-sided PC board, coded 94imp4t,b
1 Plastic instrument case, 200 x 160 x 70mm
1 2.4576MHz crystal
2 IC sockets, 28-pin (6264) and 24-pin (MAX190)
1 PC-mount 90 degree DB25 socket
1 Panel-mount DC power socket
4 Panel-mount RCA sockets
2 Knobs

Hookup wire, rainbow wire, PCB pins, blank PCB for shield (approx. 140 x 90mm), heatshrink tubing, thin packing foam (or similar).

Additional parts

Probe assembly (2 required)

2 Insulated 'alligator' clips, red and black
1 RCA line plug
1 47k resistor, 0.25W 1%

Shielded audio cable (approx 1m), heatshrink tubing.

Other:

1 x long RCA audio patch lead (mono) for the mic, 1 x medium RCA audio patch lead (mono) for the test amp, 1 x DB25 male to DB25 female lead for the PC's printer port connection, 1 x small plugpack unit, 100mA or more, 9 - 12VDC.

control of the HBEN line at pin 21, where a high level forces the MS byte to the output, and low places the LS byte on the data bus — as indicated in Fig.6.

HBEN is also applied to IC9a (pin 2), which passes HBEN to IC19 and IC15 as an address updating clock. IC9a passes HBEN to IC6a when the GO line is high (sampling is under way), which in turn drives both the address counter's CLK input (pin 10 of IC15) and the SRAM's A1 address line (pin 9 of IC19). Note that during a sampling run the GO-bar line will be low, so the output of IC9b will be high, and the XOR gate acts as an inverter to the already inverted (by IC9a) HBEN signal.

Since the SRAM's A1 address line is connected directly to HBEN, there will effectively be *two* ranges of memory locations available, depending upon whether HBEN is at a low or high logic level — for the sake of this description, we'll call these bank number one and bank number two, respectively. The address range within these banks is controlled by the address counter IC15, which advances on the negative-going edge of its clock pulse — which of course, is also HBEN.

As shown in the timing diagram then, when HBEN is low the A/D's LS byte is offered to RAM bank one, while a high level passes the MS byte to RAM bank two. The address counter then moves to next RAM address as HBEN returns to a low level, as noted in Fig.6.

Each byte is actually written into the SRAM as the WE-bar line is pulsed low by IC9d, which gates the CLK-bar signal with the Q output of IC8a (effectively the CS-bar pulse). In all, the above process lasts for 4096 sampling cycles, while each of the RAM's locations are loaded with a matching A/D data byte. And of course, the actual order of the data within the RAM locations is unimportant, provided the IMP software used to read out the data matches this arrangement.

When it comes to reading back the data to the PC via the printer port and multiplexer IC1, the address counter (IC15) and the RAM's A1 line are then controlled by an external 'software' clock, which appears at pin 2 of SKT1. This signal is first buffered by IC11b, then passed through IC9b when the GO-bar line is high — that is, when a sampling run is *not* under way.

The XOR gate IC6a then inverts the signal as before, since the output of IC9a is now high (thanks to the GO line), and the RAM locations are scanned in the same way as before — but at a rather slower pace than during a sampling run. The PC also controls the nibble select line via pin 3 of SKT1 and IC11d, and can reset the address counter via pin 5 and inverter IC11c. Also note that in this case the RAM's data pins are configured as data bit outputs — rather than inputs — when its output enable (OE-bar, pin 22) is held low by the GO line.

Power supply

The IMP module's power supply is a simple affair, based around 5V regulator device IC13, which is fed from the DC plugpack via protection diode D1. Power indicator LED1 is energised via limiting resistor R39, while C3 provides additional smoothing at the regulator's input. The resulting analog 5V line is bypassed by C4, C17 and C18, while the 5V supply for the digital circuitry is bypassed by C1, C2, C6, C8, C11 and C19.

Finally, LED2 is activated from the GO-bar line via resistor R38, which then provides a clear indication that a sampling run is under way — quiet on the set, this is a take!

That about covers the IMP module's circuitry and its operation. In the next instalment, we tell you how to assemble your own module and perform a few preliminary tests. ❖

SHORTWAVE LISTENING

Continued from page 39

Club which had its first broadcast on December 1, 1962. It continued until the 1970's, when Ian McFarland commenced DX Digest. This in turn ended in 1990 when Ian went to work for Radio Japan. The BBC first entered this interesting field in the late 1950's, and later BBC World Radio Club was formed with Henry Hatch as its compere. This programme was popular throughout the 1960's. Today, it has been re-styled as Waveguide which is compered by Simon Spanswick.

The most popular session from South America for shortwave listeners is DX Partyline from HCJB in Quito, Ecuador. This programme had its foundings with Clayton Howard, who broadcast the programme for some 18 years. Then followed several other presenters, until today when John Beck, Ken MacHarg and Rich McVicar are involved in the programme.

Across the Tasman, New Zealand had its introduction to the special shortwave programme with This Radio Age, in which Cleve Costello presented a magazine feature on electronic and communication news. In 1962, he was joined by the writer, and eventually the programme became a full 15 minutes of DX material. This was not only carried on shortwave but also on the Domestic Network of Radio New Zealand, for many years.

This Radio Age continued until the early 1980's, when Tony King started Mailbox and the DX material became part of that half hour broadcast. Today Mailbox is carried in three transmissions from Radio New Zealand International every two weeks, with Myra Oh as compere and the writer contributing material for shortwave listeners.

This review covers only international broadcasters who have shown a long term interest in programmes for shortwave listeners. Almost all international stations have a Mailbox or a DX session, but these have not been as well established as those referred to here. ❖

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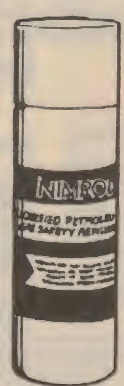

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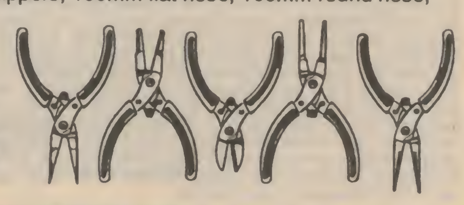
Cat T-3575

$29.95



Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide further information.

Guitar tuner

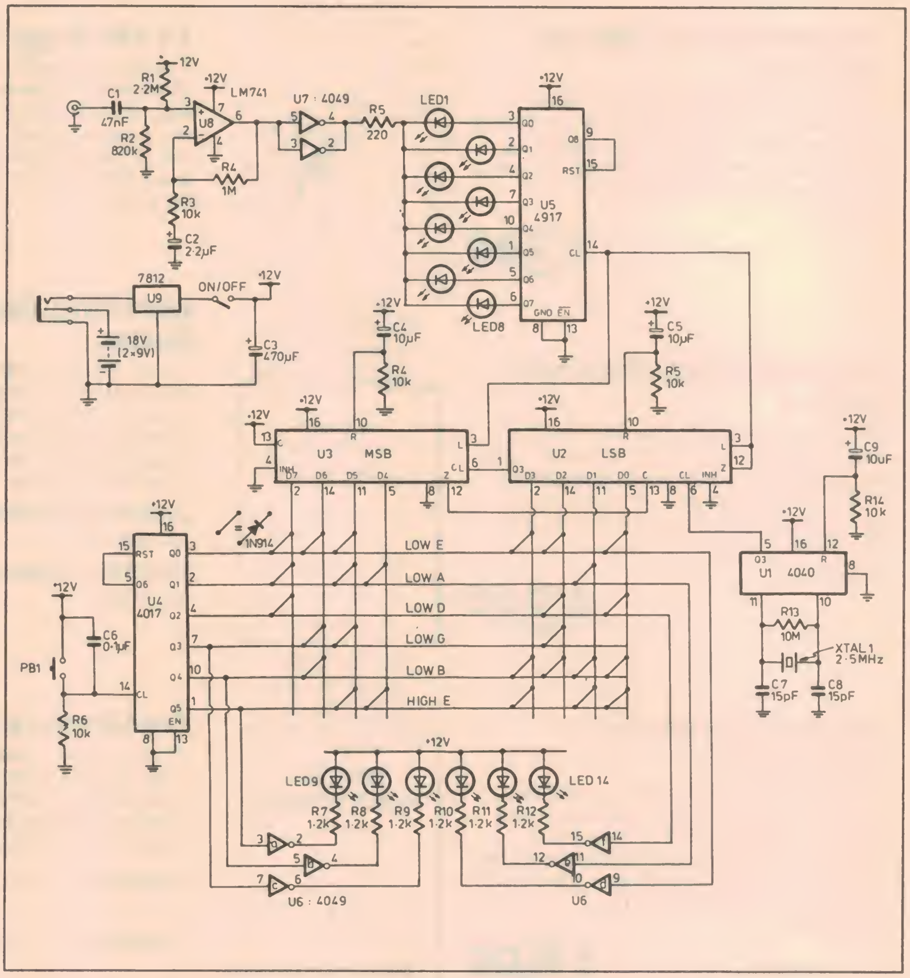
I play guitar, and needed an accurate tuning method. Commercial electronic tuners are quite expensive and the IC used in the tuner published in *EA* May 1992 is no longer available. I therefore designed this circuit, based on the May 1992 tuner. The signal buffering circuit, visual tuning indicator and power supply are the same as in the original circuit.

A precise time signal is obtained from a 2.5MHz crystal and divided down by U1. The output at Q3 is 156.25kHz (2.5MHz divided by 2^4, which is passed to the clock input of U2. This IC in conjunction with U3 divides the 156.25kHz signal down by the binary inputs present on D0 - D7. U2 and U3 are both 4526 chips.

Each time PB1 is pressed, each of the outputs of U4 go high. This in turn lights one of LEDS 9 - 14, and also presents a signal to the inputs of U2 and U3, depending on the configuration of the diode matrix. LEDs 9 - 14 are buffered by U6, and light when the appropriate output of U4 is high. The diode matrix is needed to get an accurate division of the 156.25kHz signal.

For the Q0 output of U4, the binary number 11101101 is placed on the inputs of U2 and U3. This binary number represents decimal 237 and the 156.25kHz signal is divided by 237. This results in a 659.28Hz signal being produced at pin 3 of both U2 and U3. Similarly, when output Q6 is high, the binary number 00111011 (decimal 59) is placed on the input lines of U2 and U3. This causes a 2.648kHz signal to be produced by U2 and U3.

The signal is then further divided by eight, by U5. This gives the visual indication as to how close each string of the guitar is tuned to the proper note. The 659.28kHz signal becomes an 82.41Hz signal, which is the frequency of the low E string on a guitar. The 2.648kHz signal becomes 331.04Hz, the frequency of the high E string on the guitar.



The input signal from an electric guitar or a microphone is buffered and conditioned by op-amp U8 as in the original circuit. The DC supply to the circuit is regulated to 12V by U9. Although this circuit is not as neat as the original, it has an average tuning accuracy of 0.2%.

Colin Irwin,
West Chatswood, NSW. **$60**

Gel cell battery charger

This circuit is designed to charge a 6V 1Ah sealed lead acid battery (SLA, gel cell) so that overcharging is avoided and battery life is maximised.

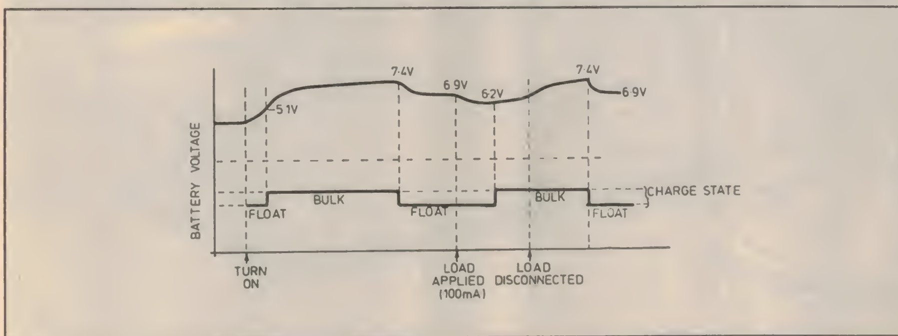
The circuit is similar to the Unitrode UC3906 dedicated charger IC, but costs less. 6V SLA chargers should obey the following rules:

1. If the battery is very flat (less than 5.1V) it should be charged at a *trickle* rate (20mA).
2. The *bulk* rate should be at C/5 and not exceed 200mA for a 1Ah battery.
3. Charging at the bulk rate should be terminated once the battery has reached 7.4V, to prevent irreversible electrolyte loss (lost capacity).
4. When not in use, the battery should be kept floating at 6.9V.

The battery can be charged in either of two ways; bulk charge through a 27 ohm resistor (200mA with a 12V supply), or trickle/float from a 6.9V source through a current limiting resistor of 180 ohms.

IC1a switches the relay to trickle charge if the battery is flat (rule 1). Once the battery voltage has reached 5.1V, charging commences at 200mA until the battery voltage reaches 7.4V.

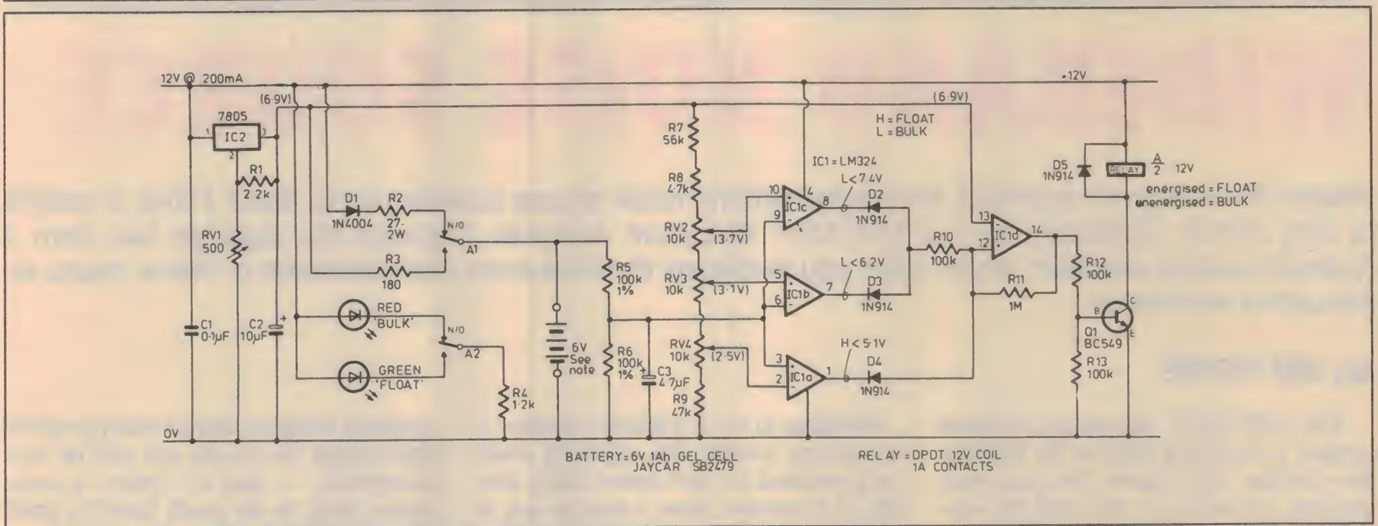
The output of IC1c then goes high, energising the relay and switching to trickle/float. The battery stays in this state until a load is connected and the battery voltage falls to 90% of the float value (6.2V). This turns the output of IC1b low, resetting the Schmitt trigger circuit around IC1d and switching the circuit into bulk mode. And so the cycle continues...



The three reference voltages should be set using an accurate digital voltmeter. Ideally, when connected to a battery, the charger should be left switched on all the time. Otherwise the battery will discharge via R5 and R6. However, the discharge current is negligible.

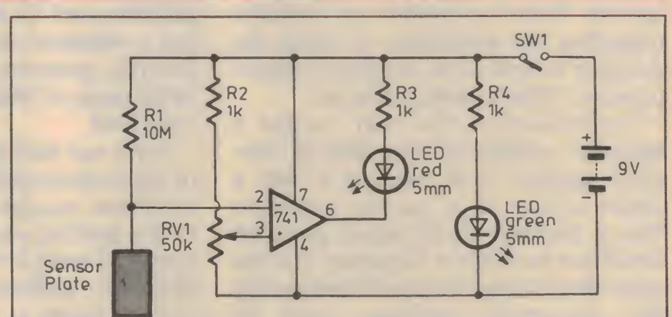
Unlike the UC3906, this circuit doesn't have temperature compensation, and is therefore only suited to indoor use.

J. Moxham,
Urrbrae, SA. **$50**



AC voltage finder

This voltage finder will indicate if cables, power points, light fittings and so on are at mains potential. It will also detect live wires through brick walls, although it cannot pinpoint their exact location. It can be set to detect mains potential in a cable located anywhere from 1mm to over 100mm away.



The 741 op-amp is connected as a voltage comparator, and RV1 sets the reference voltage at pin 3. Resistor R1 and the sensor plate form a voltage divider. When the plate is near a mains induced electric field, the voltage at pin 2 varies sufficiently to cause the red LED to light.

The sensor plate can be made from a piece of printed circuit board. The entire circuit and sensor can be fitted inside a small plastic box with the sensor plate hard up against one end of the box (copper side out).

To set the sensitivity, hold the unit near a live cable at a distance you want it to indicate a voltage, and adjust RV1 until the red LED just comes on. Now move the box away from the cable, and if the LED goes out, all is well. If not, move the box closer to the cable and readjust.

S. Crombie
Adelaide, SA **$40**

(It would be appreciated if you would contact the editorial office on (02) 353 0622, Mr Crombie. We'd like to make sure of your address so your payment doesn't go astray.)

WIDEBAND NOISE SOURCE

Here's the design for a simple, low cost wideband noise source covering up to about 1GHz. It makes a very handy accessory for our VHF/UHF Spectrum Analyser, because the together two form a 'pseudo sweep analyser' which allow you to display the frequency characteristics of filters, traps, attenuators and so on.

by JIM ROWE

The VHF/UHF Spectrum Analyser project I described back in the September-October 1992 issues has been very popular, according to the local kit suppliers. However there have been enquiries from a number of builders regarding the possibility of using the Analyser to look at the frequency characteristics of filters, traps and so on.

Traditionally, the way to use a spectrum analyser for this kind of 'network analysis' is by teaming it with a device known as a *tracking oscillator*. This is basically an RF signal generator which can be swept in frequency over the same range being swept and displayed by the spectrum analyser, and in synchronism with it — while keeping its own output level constant. By feeding the output of the tracking oscillator to the input of the filter under test, and connecting the filter output to the spectrum analyser's input, you can therefore produce a graphical display of the filter's behaviour plotted against frequency.

Needless to say a tracking oscillator is not cheap, making this approach really only practical for well-heeled R&D labs. But as it happens, there *is* another way to achieve a broadly similar result for many purposes, and it's a lot cheaper. This is to use a wideband noise source, which effectively generates all of the frequencies in the range of interest, at nominally constant level.

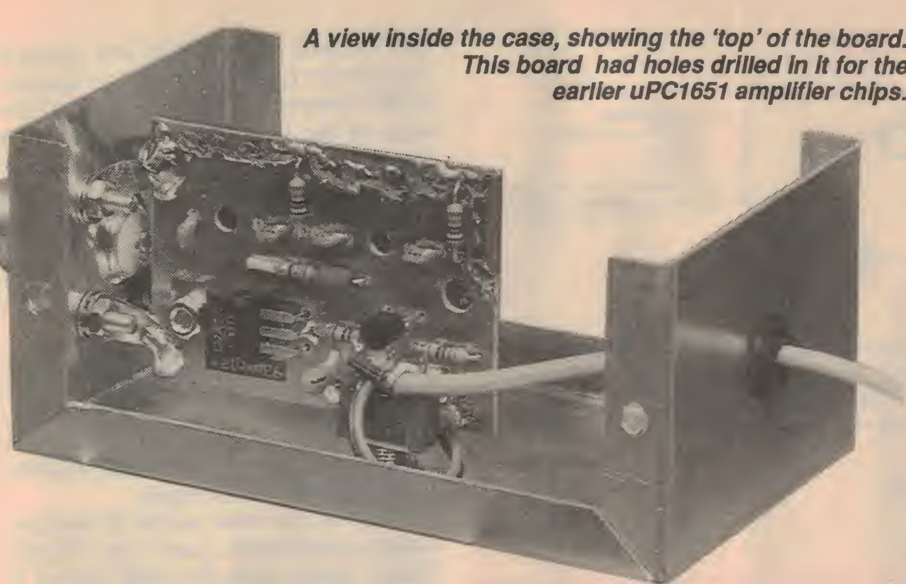
If you use such a noise source in place of the tracking oscillator, to feed the filter under test, you get much the same result as if a tracking oscillator were used. The main difference is that the noise source is effectively producing all of the frequencies of interest at the same time, rather than having a single signal which must sweep over the frequency range in time with the analyser.

This means that the resolution of this kind of 'poor man's network analyser' tends to be poorer than with a tracking oscillator, and more dependent on factors like the detection bandwidth of the spectrum analyser. But for many practical applications the results can still be very acceptable — and of course a noise source tends to be much lower in price than a tracking oscillator.

The low cost noise source described here is designed for this very kind of work, in conjunction with our VHF/UHF Spectrum Analyser. In fact it's essentially an 'optional accessory' for the Analyser, if you like, although it could easily be used with other spectrum analysers — and also for other applications requiring a wideband noise source.

It generates noise over a wide frequency range, from a few tens of megahertz up to about 1GHz — or roughly the same range as the Spectrum Analyser itself. And although the noise output may not be entirely 'flat' over this range, it's near enough for many purposes.

The noise source uses only a handful of low cost parts, mounted on a small double-sided PCB which fits inside a small metal utility case. The power re-



A view inside the case, showing the 'top' of the board. This board had holes drilled in it for the earlier uPC1651 amplifier chips.

quired is 12V DC at about 60mA, and this can be supplied from either the Spectrum Analyser's internal 12V rail, or from a separate supply if you wish.

Circuit description

The circuit of the noise source is quite straightforward, with the noise generated in the traditional way by a silicon P-N junction operated in reverse breakdown mode. It's then amplified by a cascaded pair of wideband amplifier stages, to build it up to a useful level for testing.

Although a zener diode can be used to generate noise at lower frequencies, its output at higher frequencies tends to be poor due to the relatively high value of depletion layer capacitance. Since in this case we're after wide bandwidth, we use instead the base-emitter junction of a UHF amplifier NPN transistor, the BFR91 (Q1). This comes in a 'small outline' SOT37 package, and is readily available (although not cheap — around $10 each).

The base-emitter junction of a BFR91 tends to break down at between 2V and 5V of reverse voltage. To maintain it in this condition without damage, we drive it here via a constant-current DC source, formed by transistor Q2 with 3.3V zener diode ZD1 and resistors R4 and R5. As Q2 acts to balance the voltage across the zener diode against the sum of its own Vbe and the drop across emitter resistor R4, this produces an emitter/collector current of (3.3 - 0.7)/1k, or about 2.6mA. And this current stays relatively constant, despite variations in the nominal 12V DC input voltage.

The collector current from Q2 flows down through the base-emitter junction of Q1, and then to ground via RF load resistor R1. Capacitor C6 provides an RF bypass at the emitter of Q1, so all of the noise generated in the base-emitter junction will appear across R1.

The noise voltage produced across R1 is then coupled via capacitor C1 into wideband amplifier U1, which in turn drives another identical device U2 via coupling capacitors C2 and C3, and intermediate load resistor R2. The output of the second amplifier is then coupled to the output connector via C4.

Amplifier devices U1 and U2 are made by NEC, and are type uPC1688G — described as a wideband and flat gain silicon bipolar monolithic circuit. This device has a power gain of about 21dB, and an almost constant gain up to around 1GHz. It comes in a very tiny four pin surface-mount package, measuring 1.5 x 3mm.

Incidentally, I first designed the circuit around the earlier uPC1651G wideband amplifier device, which has been stocked by Dick Smith Electronics for the last few years. But just as the design was nearing completion, DSE advised me that NEC had discontinued the uPC1951G. Happily DSE was also able to obtain for me samples of the suggested replacement devices, for testing. From these I was able to select the uPC1688G, and I understand DSE will be stocking this type to replace the original device.

Needless to say Murphy's law operated — the new device is in a rather different package to the original, so the PCB design had to be altered. But better to discover this before publication than after!

Like the earlier device, the uPC1688G is designed to operate from 5V DC and this needs to be carefully regulated. As a result, regulator U3 is used to derive a well-regulated 5V rail from the nominal 12V input. Output device U2 is supplied directly from the output of U3, while U1 is decoupled via resistor R3 and ferrite bead B1 to ensure stability. This is also the reason for bypass capacitors C7 and C8, which are connected right across the supply pins of U1 and U2 with the shortest possible lead length.

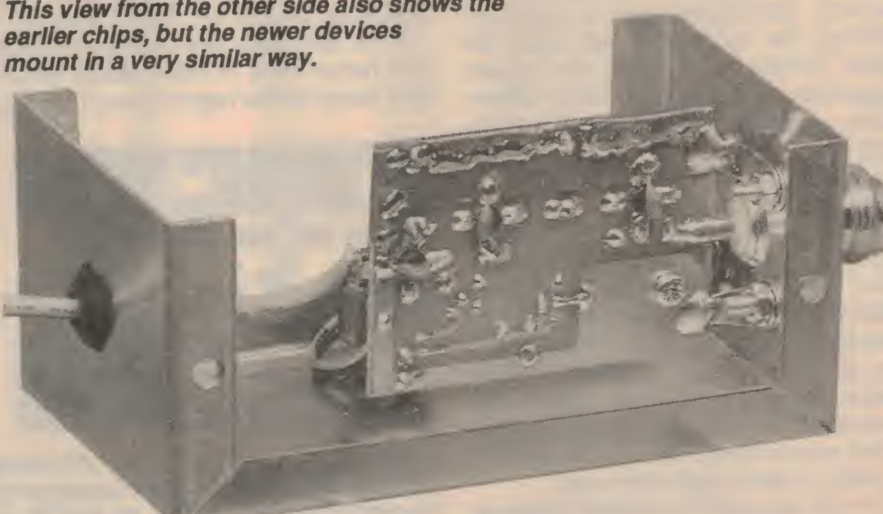
Construction

The noise source is built on a small double-sided PC board, measuring 54 x 38mm and coded 94wng7. Basically the copper on the top of the board is used as a ground plane, to ensure that the wideband amplifier stages remain stable.

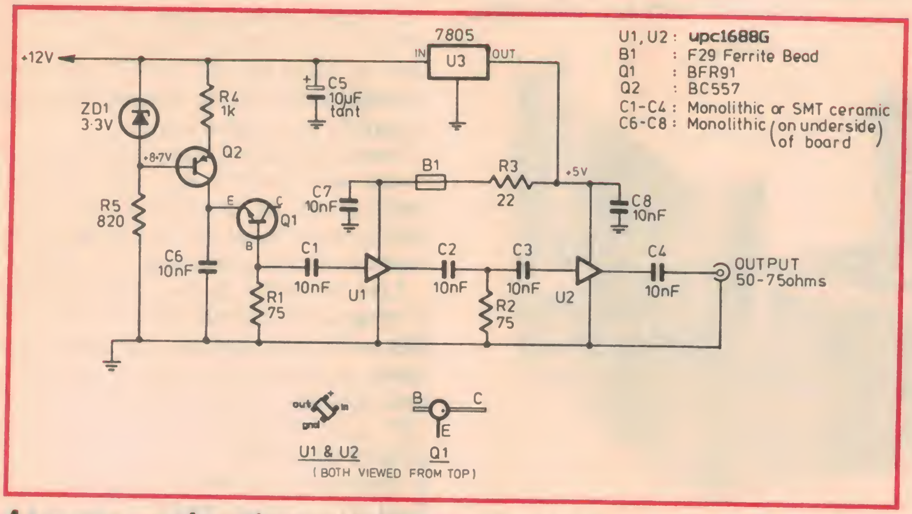
Before mounting any of the components on the board, it's a good idea to inspect the 'top' surface with a magnifying glass, to ensure that the ground-plane copper is well clear of the holes where insulated leads will be passing through. If the copper seems too close to any of these holes, relieve it by lightly chamfering using the point of a 3mm twist drill, held either in your fingers or a hand-held collet chuck (NOT a power drill!).

Most of the components are mounted as usual on the 'top' of the PCB, but the

This view from the other side also shows the earlier chips, but the newer devices mount in a very similar way.



Wideband Noise Source



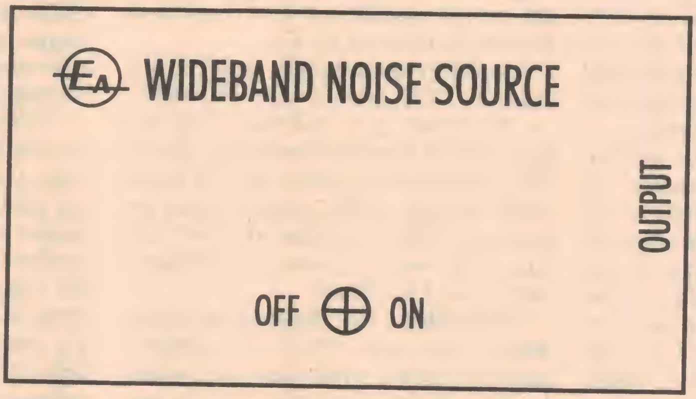
As you can see from the schematic, the noise source uses only a handful of components. The base-emitter junction of transistor Q1 generates the noise signals, which are then amplified by U1 and U2.

exceptions are noise source Q1, amplifier chips U1 and U2, and bypass capacitors C6, C7 and C8. These all mount on the bottom side, with a 4.5mm diameter hole drilled in the PCB under the plastic body of Q1 so it sits in the hole with its leads flush with the board copper. Note that the longer collector lead is used to determine the correct orientation for Q1 (the small dot indicates the top of the body), but all three leads should be trimmed shorter before the device is soldered to the board, to prevent shorts.

Amplifier chips U1 and U2 are angled so their tiny 'gull wing' leads mate with the pads on the board, and are then directly soldered. Needless to say, both these and Q1 should be soldered quickly with a low-power, precision iron to prevent damage due to overheating. After the three devices are fitted, the bypass capacitors are mounted directly above them, with the shortest possible leads and again taking care not to overheat the components.

By the way, you need to be especially careful in orientating the uPC1688G devices correctly. They are so tiny that there are none of the usual dimples or colour spots to indicate the indexing pin. Instead, if you look very closely you'll see that one of the four pins is slightly wider than the other three. This is the *ground* pin. All four pins are already bent down towards the *bottom* of the device, to make it clear 'which side is up'.

The photos and PCB overlay diagrams should make most of this fairly clear, although the photos were taken with the original uPC1951G amplifiers in place. These required clearance holes in the PCB, as used for U1; the holes are not needed for the new uPC1688G devices.



If you would like to duplicate the author's prototype source, here is the artwork for the front panel, actual size.

From the photos you can also see that in a further effort to ensure stable operation, the grounded copper areas of the top and bottom of the PCB are bonded together by bending three short lengths of thin copper foil or 'shim' around the edge of the board, and soldering it to the copper on each side. Two lengths of shim measure 20 x 10mm, and are soldered along the long edge between R1 and R2, and from R2 to the output end (near U2 and C4). The third length measures 13 x 10mm, and is on the short edge alongside R1.

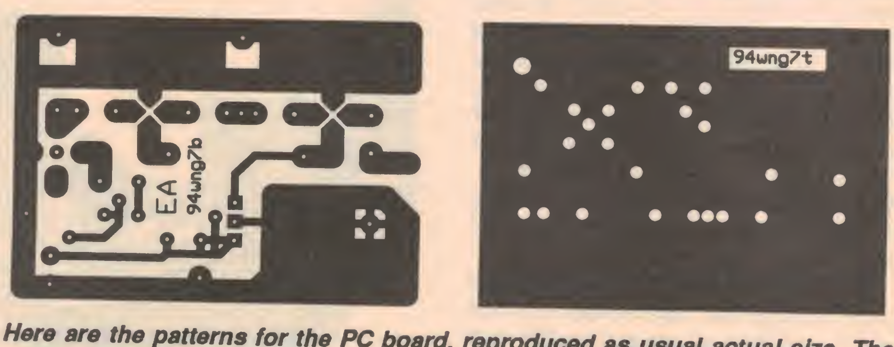
Further points to watch in assembling the PCB are that ferrite bead B1 (an F29 type) slips directly over one lead of R3, while resistors R1 and R2 should be mounted as close to the PCB as possible, to minimise their lead length.

In fact if you have access to surface-mount components, you'll get slightly 'flatter' output from the noise source if both of these resistors are of this type, rather than standard leaded resistors as shown. In this case they would be mounted on the underside of the board, of course. The same comments apply to coupling capacitors C1-4, and even bypass capacitors C6-8 — although SMT bypass capacitors may present mounting difficulties.

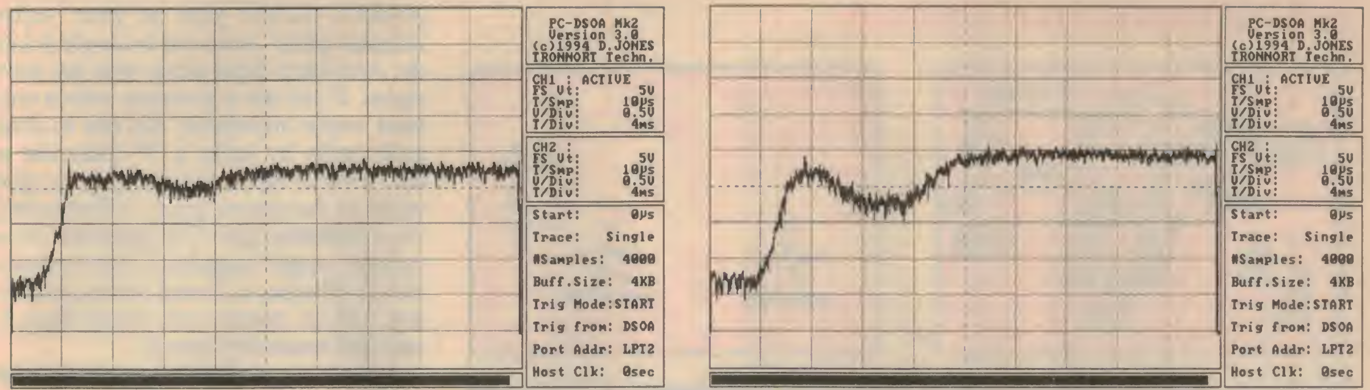
The PCB pattern has actually been designed to allow either leaded or SMT components to be used for R1, R2 and C1-4. There's even room for fitting two 150-ohm SMT resistors side by side (i.e., in parallel) for both R1 and R2, if you can't get 75-ohm SMT resistors.

Note that the voltage regulator device U3 is mounted flat on the top of the board, with its three leads bent at 90° to mate with the PCB holes. A 10mm x 3mm machine screw and matching nut are used to fasten the regulator tab to the board, and provide optimumheatsinking.

The PCB is designed to mate with a standard panel mounting N-series UHF



Here are the patterns for the PC board, reproduced as usual actual size. The pattern for the bottom of the board (left) is arranged to allow either leaded or SMT components for resistors R1 and R2, and also capacitors C1 to C4.



Captured with the aid of the author's DSO Adaptor and Tronnort Technology's matching software, these plots show the output of the noise source on the low-VHF and high-VHF bands, as seen on the Spectrum Analyser. To a large extent the plots represent the response of the Analyser on the bands concerned — as explained in the text.

connector, of the flange type with four mounting holes. As you can hopefully see from the photos, the board is actually supported at the rear of the connector by fitting a solder lug under each nut and star lockwasher at the rear of the mounting screws, and soldering the lugs to the ground copper on each side of the board. The centre spigot of the connector is then soldered to the 'active' output track of the PCB, to complete the job. This simple mounting scheme holds the board assembly quite firmly in place, as it is very small and light.

As you can also see, the noise source is housed in a small aluminium utility case measuring 100 x 60 x 45mm. The output connector mounts centrally on one end, while a shielded lead carrying the +12V DC from the Spectrum Analyser enters via a grommetted hole in the other end. A miniature SPDT toggle switch is mounted on the 'top' of the case, to turn the noise source on and off.

For those who would like to duplicate this arrangement, I have prepared artwork for the case 'front panel', and this is reproduced in the article actual size along with the PCB etching patterns.

In the case of the prototype, the shielded 12V lead was terminated in one of the miniature 'concentric' DC power plugs, with a matching socket fitted to the rear of the Spectrum Analyser and connecting to the latter's +12V and earth rails. This provides a simple way to power the noise source directly from the Analyser.

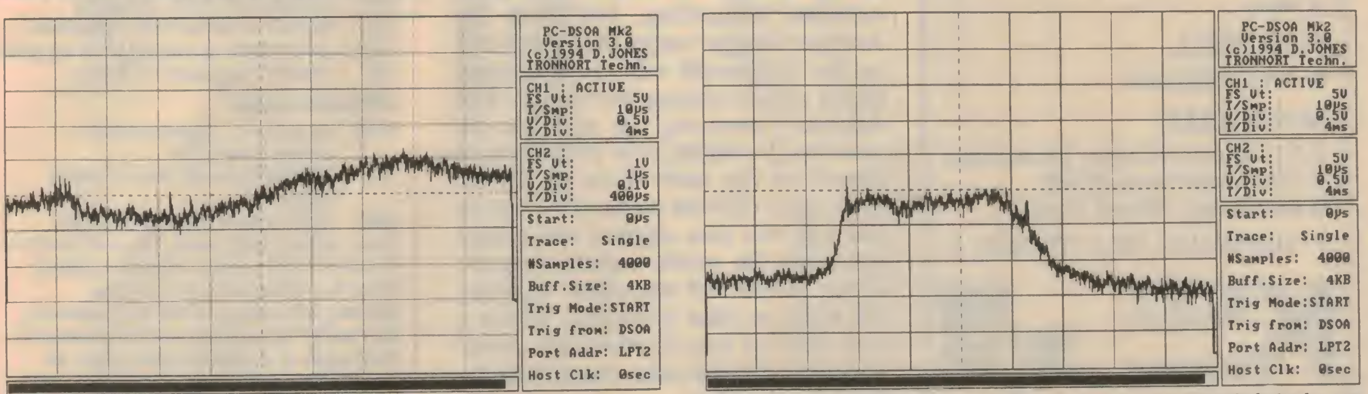
Using it

There's basically nothing to adjust or set up in the noise source; if you've wired it up correctly, it should begin producing wideband noise as soon as 12V DC is applied. However before closing a few comments are no doubt in order, about using it to best advantage.

Although the output of the source itself appears to be fairly flat over the range covered by the Spectrum Analyser, you'll find that feeding its output directly into the Analyser input will show curves that are *not* flat, particularly when you have the Analyser's sweep width control set to maximum (i.e., to cover all of each band). This is visible in the first three sample plots shown: one for the low VHF band, one for the high VHF band and the third for the UHF band.

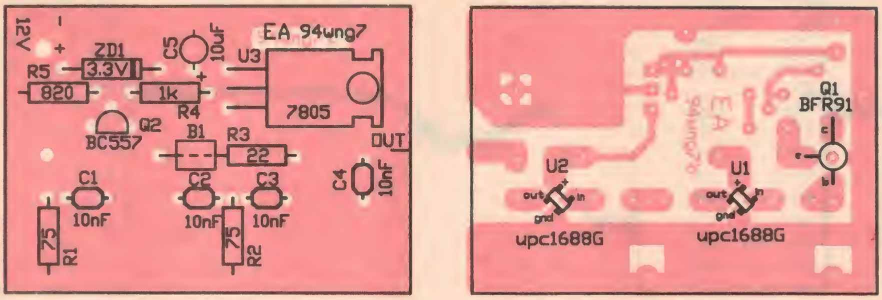
Most of the reasons for these apparent deviations from flatness is basically the response of the tuner module in the Spectrum Analyser itself. In the low VHF band, for example, it seems to have a shallow dip in the region around 70-80MHz (perhaps deliberate, to reduce cross-modulation from low-band mobile signals); similarly in the high VHF band there's a rather more prominent dip around 145 - 180MHz, perhaps for the same reason.

As you can see the UHF band response (taken with a cable only 200mm long, and a 75-ohm terminating load in parallel with the Analyser) appears to have a very shallow dip centred on about 600MHz, and an equally shallow peak centred on about 750MHz (most of the smaller peaks are due to UHF TV signal breakthrough). However my impression is that at least some of this variation may be due to cable reflections; the apparent shape of the full UHF band response can vary, according to both the length and impedance of the cable connecting the two instruments, and the impedance of any terminating load connected at the Analyser end. If you use a longer cable (say 2m) of say 50-ohm impedance, you tend to get a larger number of 'ripples' in the curve, and their amplitude and spacing varies according to the terminating impedance.



The first of these plots (left) shows the response of the Spectrum Analyser's UHF band, while the second plot (right) shows the response of a UHF bandpass filter. The marker 'pip' at the top of the left-hand skirt indicates a frequency of 480MHz, while the pip just down the right hand skirt is the sound carrier for Sydney's SBS 28, at 532.75MHz.

Wideband Noise Source



Use these overlay diagrams as a guide to fitting the components on the top (left and bottom (right) of the noise source PCB. Note that the ground pin of U1 and U2 is slightly wider than the other three, and the collector pin of Q1 is longer than the other two. Take great care to avoid overheating when soldering in these parts.

While these deviations are clearly evident on the 'full band' sweeps, they are really not all that large and don't present much of a problem in practice. That's because in most cases you're examining the response of a filter or trap, etc., over a relatively narrow segment of the spectrum, where the response of both the Analyser's tuner and the noise source itself are much closer to flat.

By the way, the steep drop visible at the left-hand end of both VHF response curves is purely because the sweep range used to produce the plots concerned was actually wider than the bands concerned, and we're seeing the tuner's really steep roll-off at the lower edges of the bands. In fact the small marker pips visible in each case, just before the steep drop, indicate the nominal lower limits of the bands — at 53MHz and 138MHz respectively.

The fourth plot shown is the response of a UHF bandpass filter, built using three coupled microstrip lines. The sweep range and centre frequency controls of the Analyser were set to cover from about 470 - 550MHz, and the 'flat' section of the filter covers from 480MHz to 527MHz. Using the noise source and the Analyser it was quite easy to adjust the filter for this reasonably symmetrical response. Note that the marker pip on the left-hand end of the filter plateau is the signal generator, set for 480MHz, while the pip just down the upper skirt is the sound carrier for Sydney's SBS channel 28, at 532.75MHz. (The picture carrier is less visible in this capture, but is present at the top of the same skirt.)

By the way, all of these response plots were obtained using our new PC-Driven DSO Adaptor, coupled to the Spectrum Analyser and adjusted so it could capture a single sweep. The DSOA was set for external triggering, fed from the Analyser's trigger output (rear panel) and set for 10us/sample with 4K of memory depth (representing 40.96ms). The Analyser's sweeping rate was then adjusted to give slightly over 25 sweeps per second, or just under 40ms per sweep. Each curve obtained on the PC screen in this way was then captured and printed out using the screen capture program *Pizazz* (which will also allow exporting the image to other packages). This is a very practical way to record the results obtained using the noise source with the Spectrum Analyser.

Perhaps I should note that in order to use a standard signal generator to produce marker pips on your 'noise response plots', you need to couple it into the Analyser's input along with the noise signal. If you use a generator with a constant output impedance, this can be done quite easily by using a 'T' connector at the Analyser input, and coupling the generator to the second input — if necessary via a matching pad. Our generator has a constant output impedance, for example, but it's 50 ohms so I need to use a matching pad to ensure that everything is matched reasonably closely.

A final suggestion. I haven't had the chance to try it as yet, but the noise source and Spectrum Analyser should also be able to display the resonant frequency of an antenna, if a cable from the antenna is simply tapped in at the input to the Analyser. There should be a clear 'notch' produced at the antenna's resonant point, as it absorbs maximum energy. Ideally the cable between the antenna and the tapping point should be an integral multiple of an electrical half-wavelength at the frequency concerned, to reflect its impedance accurately; but even a bit of error here shouldn't make a great deal of difference.

In short, I think you'll find the noise source a very handy accessory for the Spectrum Analyser. For less than $50 or so, it really enhances the uses for your Analyser. ❖

PARTS LIST

Resistors

R1,2	75 ohms (1/4W composition or SMT)
R3	22 ohms 1/4W composition or MF
R4	1k 1/4W composition or MF
R5	820 ohms 1/4W composition or MF

Capacitors

C1-4	10nF 50V monolythic ceramic or SMT
C5	10uF 16VW tag tantalum
C6-8	10nF 50V monolythic ceramic

Semiconductors

ZD1	3.3V 400mW zener diode
Q1	BFR91 UHF NPN transistor
Q2	BC557 or similar PNP transistor
U1,2	uPC1688G wideband UHF amplifier
U3	7805 5V regulator (TO-220)

Miscellaneous

PCB	54 x 38mm, double sided, coded 94wng7b/t
B1	F29 ferrite bead, 3mm outside diameter
SW	SPDT miniature toggle switch
Case	Metal utility case, 100 x 60 x 45mm

N-series UHF socket, flange mounting type; five 10mm x 3mm machine screws, with nuts and star lockwashers; four solder lugs; 10mm rubber grommet; 2m length of shielded audio cable, for power lead; concentric power plug and matching socket; 53 x 10mm piece of copper foil for PCB edge bonding; front panel dress foil.

Continued from page 51

Proofing exercise, I had two blokes supervising the oven operations and I cannot print the threats under which they wereoperating.

Thanks C.J. I can imagine the panic when that soldier got back from the toilet. I suppose he did the right thing coming to you, but for me, I'd probably have set off south and not stopped until I reached Hobart! Just the same, I'm glad I never had to service one of those sets after their immersion in 'Chlorinated Rubber (Pink)'. It is bad enough having to scrape through varnish to remake a solder joint. Trying to solder over or through pink rubber sounds to me like an olfactory nightmare! Thanks for the story, anyway.

Lather it up...

Now for a short tale to end this month's column. It comes from W.L., of Zillmere, in Queensland. It was a toss-up whether this story appeared here in the body of the column, or as an extended panel under 'Just For A Laugh'.

It's another of those tales that at first telling seems just too crazy to be true. Yet every serviceman can tell about mad customers and their ridiculous actions, so I have no doubt that this really happened to W.L.

Here's what he has to say:

I call this story 'The Hairy VCR'.

I am a retired electronics engineer and occasionally take in a friend's TV or VCR for repair, as a favour.

The other day, a friend of a friend asked me if I would take a look at his VCR, a Panasonic NV450, which his brother had tried to repair by cleaning the heads with, of all things — SHAVING CREAM! (I wonder if he used a brush to apply the cream?) The mind really boggles at some of the things the 'cowboys' get up to. I also find it amazing that whenever a VCR goes on the blink, people always assume that it's 'the heads that need cleaning'. In the days of the valve TV, it had to be 'a valve' that was causing the fault, though they never told you which one! With radios, it was always a 'broken wire'.

(On the contrary, W.L., my valve customers ALWAYS told me which valve it was. It was never anything other than 'the picture valve'! Even today, it's still 'the picture transistor' — Serviceman)

Anyway, the VCR in question was easily fixed. On opening it up, the fault was staring me in the face. The tension brake band was hanging loose and the felt pad was lying in two pieces, on the bottom of the deck.

Installing a new band and giving everything a good clean soon got the machine back into the land of the living.

Although the heads, including the audio/control ones, needed to be cleaned several times to remove the last traces of dried-up shaving cream, before a prime picture was obtained!

I've heard of people using all manner of substances to clean electronic equipment. One bloke I know used 'Solvol' to clean his TV screen — it finished up like frosted glass! But I've never heard of shaving cream being pressed into service. Still, I suppose the fellow reasoned that shaving cream is only a form of soap — prelathered it may be — but still only soap. And soap is used for cleaning things. Why not video heads? Well, if nothing else, it was a source of income for somebody.

Thanks, W.L. Your story is a good note to finish up on. ❖

AUTOMOTIVE ELECTRONICS

with MAJOR AL YOUNGER (USAR, Ret.)

Electronics in other areas of a modern car

Most of us realise that the electronic fuel injected or 'EFI' car has a computer for engine management, and that some also have another computer to control the automatic transmission. But I've received quite a few letters from readers asking for details on any other electronic systems that are used in modern cars. So let's take a look at some of these systems. Remember, they need to be fixed too — there's money under that 'thar' bonnet!

Way back, the first electronic devices in cars were regulators for the alternators. They were sealed units and not easy to repair, but they still had to be *tested*. The importance of testing cannot be overstated, since in almost all areas of electronics, 70% of devices tested turn out to be all right — or to use that great American word, 'OK'.

The second device on the scene was the electronic ignition. Again, most were sealed, but all required testing.

We cannot cover here in detail all of the electronic 'goodies' in a modern electronic car. There are too many of them — look at that advertisement on TV for the Mitsubishi, with its myriad of electronics. So we're just going to look at the main ones. But remember — *someone* has to test all these components, and it might well be you!

Cruise controls

The first electronic units that made me a lot of money, as an autotech, were cruise controls. Most are not sealed and can be fixed for a small outlay and large profit. These controls preceded the computerised cars, as they were in the US marketplace in the 1970's.

Cruise controls are becoming quite popular in Australia. You can actually control the car with your fingers. It should be used on the highway only, of course. A warning from my daughter: "Cruise controls are dangerous — if you fall asleep behind the wheel". She has a brand new car with cruise control, which she has never used. Naturally, if you fall asleep behind the wheel, you're heading for trouble with or without a cruise control...

Fig.1 shows a block diagram of a cruise control system. The control electronics has two inputs, the command speed signal that indicates the desired speed and the feedback speed signal that indicates the actual vehicle speed. The control electronics detects the difference between the two inputs (the error) and produces a throttle control signal which is sent to the throttle actuator. The throttle actuator sets the engine throttle position to alter the engine speed and correct the vehicle speed error detected by the control electronics. The units are very reliable, although there are occasional problems with the actuator.

The most common problem with cruise controls is the loss of the feedback signal from the VSS (vehicle speed sensor). Fig.2 shows a typical VSS, which receives mechanical information via the speedo cable, and converts it into electronic pulses.

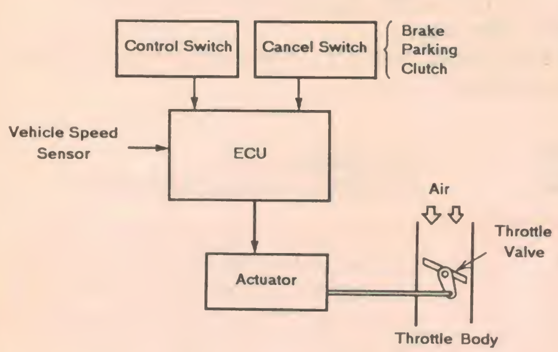
The speedo cable comes from the transmission. The cable has a seal on the transmission end, to stop fluids from entering the cable itself. When this seal fails, these fluids can enter the VSS and more or less 'shut off the light'.

I have fixed many of these units by just disassembling and cleaning them. This cause of a cruise control problem is indicated if the speedometer and trip meter (if fitted) are not working, as well as the cruise control — they generally all use the output pulses from the VSS.

Electronic ABS

As the name implies, anti-locking braking systems (ABS) or anti-skid systems are designed to prevent loss of vehicle control due to skidding — caused by the wheels being completely locked (not rotating). Under this condition, vehicle control is lost.

An ABS controls braking to slow the wheel speeds down on an individual basis. A typical system is shown in Fig.3.



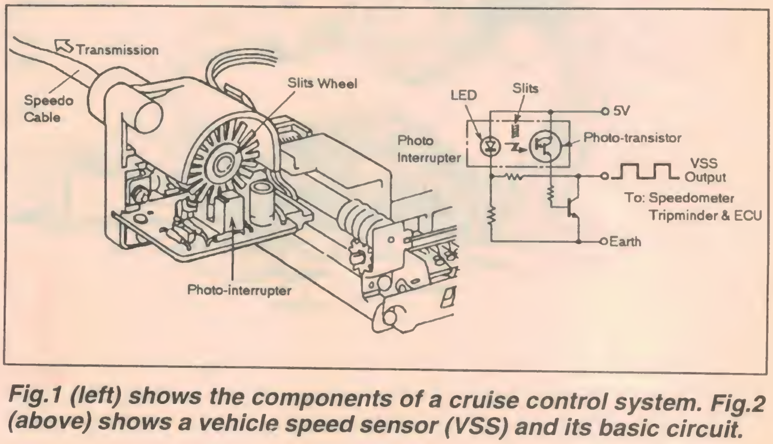


Fig.1 (left) shows the components of a cruise control system. Fig.2 (above) shows a vehicle speed sensor (VSS) and its basic circuit.

There are two-wheel (rear wheels only) and four-wheel ABS systems. I have owned cars with ABS and on two occasions, I feel that this feature saved me from tragic accidents.

Current ABS systems are very sophisticated; Fig.4 shows the electronics of a typical system in more detail. All ABS systems have their own ECU.

If you never get into a situation where the ABS comes into operation, you may never know the car is fitted with one. If required, the system will quickly apply and then release brake cylinders to correct for a skid condition.

The default for the ABS system is normal braking. So don't worry — if the ABS fails, you still have brakes. Of course a lamp will illuminate on the dash, indicating an ABS failure.

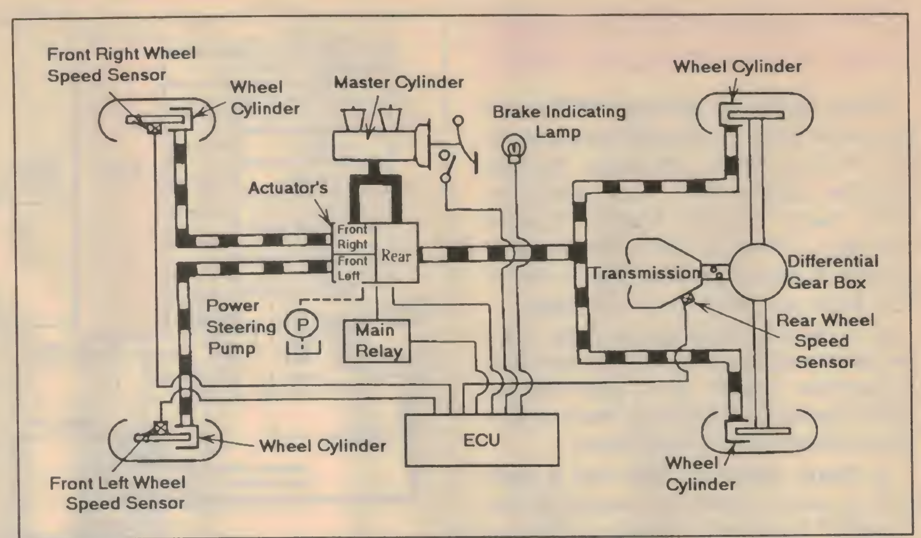


Fig.3: An electronic anti-locking braking system (ABS).

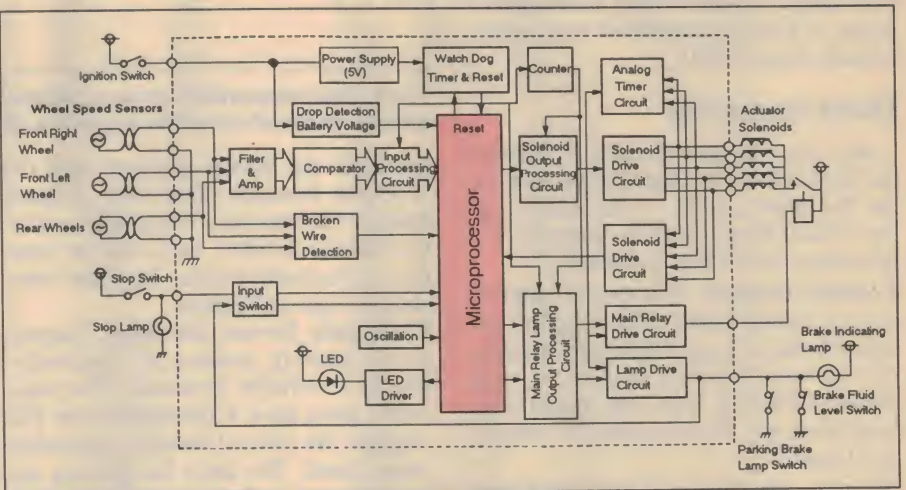


Fig.4: The electronic section of an ABS, showing what's inside the ECU.

Height/level controls

These are an electronic reincarnation of much older non-electronic systems known as 'load levellers', used in conjunction with a trailer. These were/are designed to level the car by adjusting the suspension to compensate for the additional weight on the trailer hitch (or rear bumper). Of course. the new electronic systems are all automatic (Fig.5).

Some current car models have a 'height' or 'level' control, which just raises or lowers the front of the car, to level it. Of course a level car 'handles' better on the highway. Here again, the system has its own ECU.

Full suspension control

Much more elaborate are the Integrated Suspension Control Systems, which involve very high tech dynamic control of the struts (shock absorbers and springs) for driving control (Fig.6). The force of the struts are changed according to driving conditions. For instance, if the steering sensor indicates a right-turn, the ECU signals for more pressure on the left struts, which allows a high speed turn with better safety.

This type of system also corrects for passenger load, and will raise or lower strut pressure to keep the vehicle level. It is fitted to vehicles with individual four-wheel suspension.

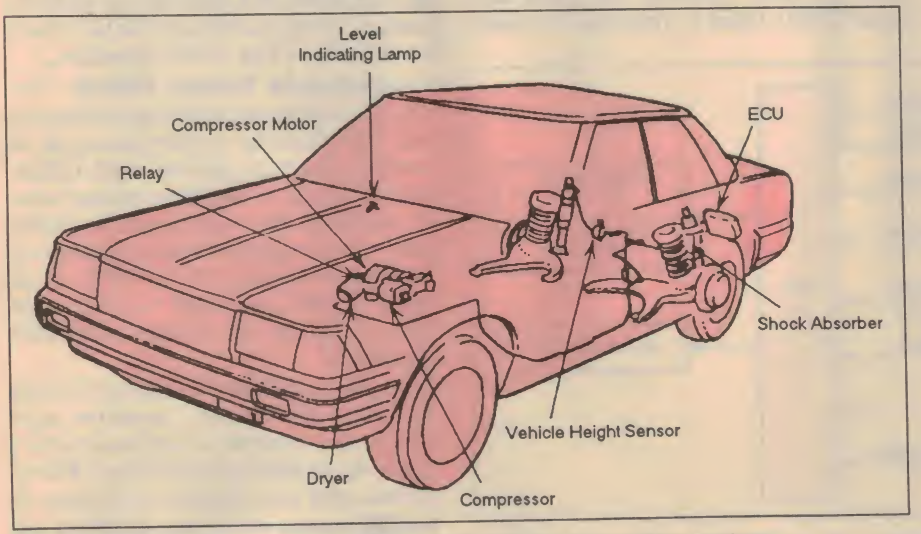


Fig.5: The basic components of an electronic load levelling system.

Speed control systems

This type of system is basically designed for racing cars, as the main controlling factor is speed (Fig.7). It controls strut damping force for high speed turns, and lowers the vehicle, depending upon speed.

I have driven in a vehicle equipped with such a system. The faster the vehicle drove, the lower to the ground the body went. It would level under *any* kind of load (passenger) conditions.

Electronic dashboards

Electronic display dashes are often referred to as 'instrumentation electronics'. As you can see from Fig.8, the displays are controlled by a dedicated microprocessor (surprised?).

These dashes are just large PCB's, and they tend to have the same problems as any PCB — opens and shorts. Novices mucking around have been known to blow tracks in these boards. Another common failure is the three-terminal voltage regulator devices, which can go bad. Most are either 9 or 5 volt types.

In Australia, Melbourne firm VDO manufactures electronic dashes for many automobile makers. It's a multi-million dollar business. They also have a very good business fixing bad boards.

In North America, GM had a dash with a touch screen to control all the 'comfort' functions — that's air, heating and the radio/music system. It would even check out the vehicle for burnt out lamps. If I recall correctly it is an option costing about $3000...

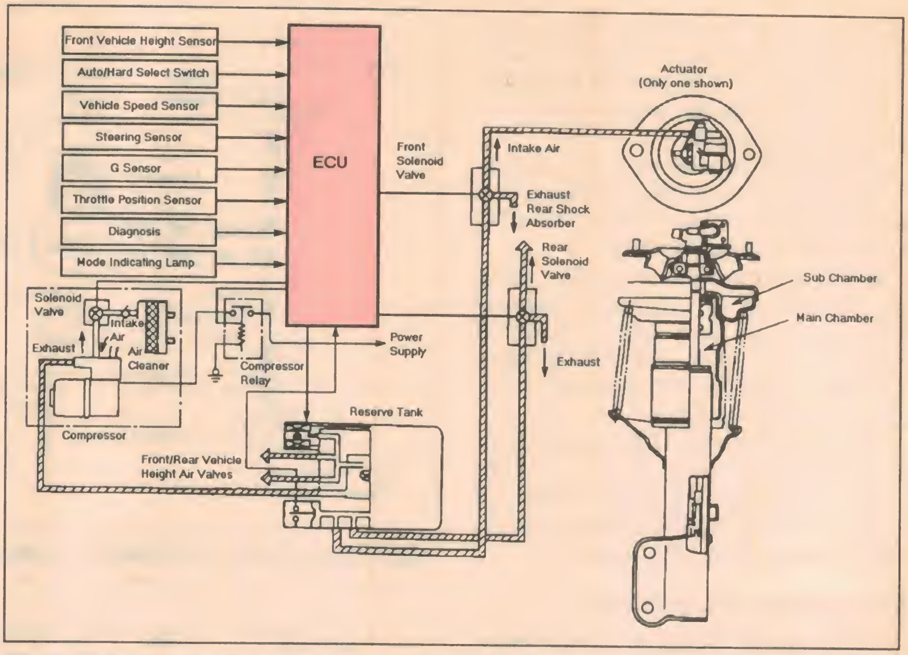


Fig.6: The components of an integrated suspension control system, and also the construction of one of its actuators (right).

Odds and ends

As you can see already, a modern automobile may be loaded with electronics. But there's more — too many to go into detail. Here's a brief rundown on a few more, with a few comments:

Comfort Control: This device controls the air conditioning and heating systems. Some of these units make the central air conditioning system in your home (assuming you can afford one) look like a toy. You program the settings and forget it.

Electric windows and door lock systems: The latest technology finds electric windows integrated with door locking, and in some cases also with the alarm system.

I watched a demonstration of one of these systems, that showed what happened when the system went into 'default' mode. When the system ECU was disabled, the doors unlocked and the windows lowered. Now that's a good feature. The devices for locking are electric and the window units may be electric or electro/hydraulic. In either case, someone has to fix them.

Electronic Power Steering: Current power steering systems are electro/hydraulic or straight hydraulic. The electronic units have a microprocessor that changes the ratio of turning, depending upon speed. The ratio for parking approaches 1:1 — that sure makes parking easy! The new four-wheel steering systems are computer controlled; if a failure occurs, they revert (default) to standard two-wheel (front) steering.

Global Navigation System: This one is right out of *Beyond 2000*. There's a system in North America that costs less than $2000, fitted in your car. Of course it only works in North America, since that's the area covered by the internal map display information. The system uses the signals from the US Military's GPS (Global Positioning System) satellites, which are constantly orbiting the Earth. It uses this information to display your current position on a map display, and can also guide you in following the best route to a programmed destination.

A similar system is available here for boats, and could possibly be fitted to a car. Compact hand-held GPS receivers are available from firms like Sony and Icom, of course.

Electronic Obstacle Detection System: This is designed to help when you're parking. Some will automatically park the vehicle — again, right out of *Beyond 2000*. But they are no good for parking in the middle of a field. (That's a joke, son — Get it? No obstacles...)

Computerised Engine Mounts: Yes, you guessed it, an engine mounting system controlled by a microprocessor. A normal mount is *passive*, with rubberised cushions to eliminate transmission of vibration. The new mounts are *active* like a shock absorber. The vibration is monitored and sent to the ECU, which sends signals to cancel out the vibes. Such units are on test cars now. How about that?

Noise cancellation: In some of the new top-of-the-line models, an active noise cancellation system is used to achieve a lower noise level inside the car. Microphones pick up vibration and other unwanted noises, which are amplified and used to produce sounds of the opposite

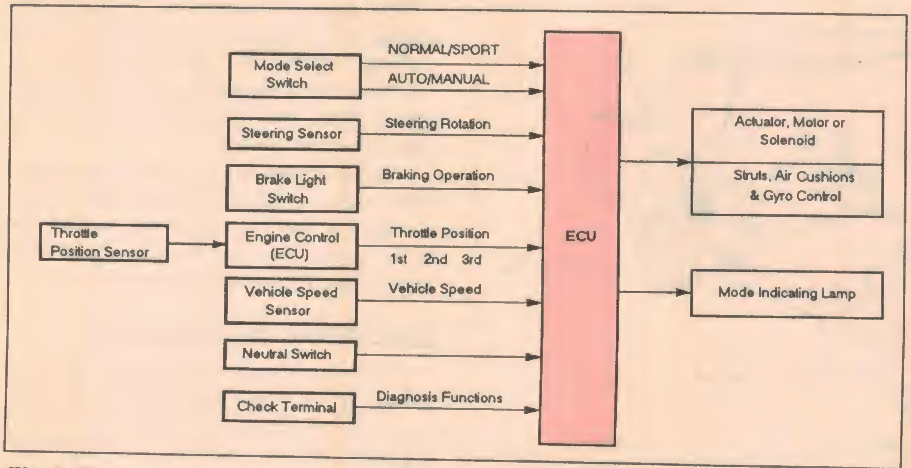


Fig.7: The type of speed/suspension control system fitted to racing cars.

phase inside the car, so everything cancels out. The same principle is being used in those new headphones designed to let you hear the movie sound, in airplanes. I can see it now — my car and I flattened by a semitrailer that I didn't even hear!

Room for more

So, the automobile is opening up a whole new field, one that I like to refer to with the same name as this column: automotive electronics. And all those electronic 'goodies' in modern vehicles will have to be maintained. By the mid-90's, Detroit (the auto industry) will spend in the billions of dollars, just for microprocessor chips.

In North America, high intensity LEDs will be introduced in the 1995 models, for brake lamps (red) and turn indicators (yellow). This will place the LED industry in the billion dollar business category.

Now if you want to enter the business of repairing all these goodies — don't ask me for information, because it's not available. At the recent Australian Automotive Trade Fair in Sydney, I met two companies that are very committed to this field. I congratulated them on their endeavour and for their perseverance, in

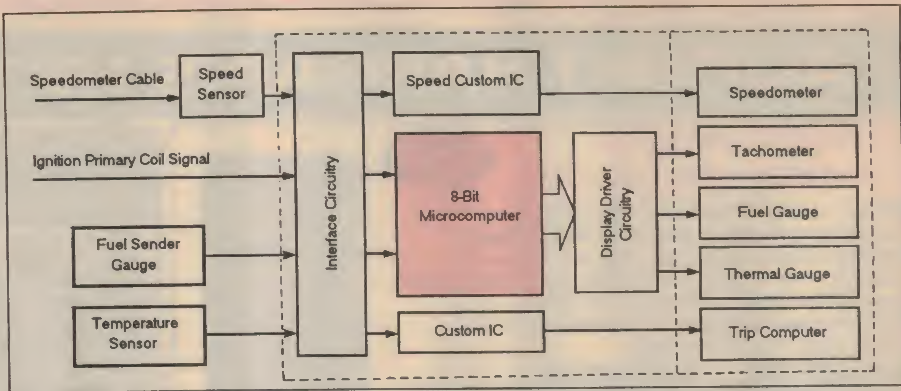


Fig.8: An electronic dashboard display system, again based on a micro...

sticking to a field where there's little or no information on the products you're trying to fix.

I chided one, and asked how many schematics he had on the ECU's. It turned out that they did have schematics on a few popular models, *which they had traced out themselves*. But he said they found no particular benefit in having a schematic.

Basically they relied upon their knowledge of processors and used the pinout information, which is available in the vehicle manuals.

The bottom line is that the schematics for any of this auto electronics gear are currently not for sale, at any price.

Conclusion

Yes, there is a lot of money to be made in automotive electronics. The hard part is getting started, since there's currently no school to train you and little or no information available.

If you are interested in the field, I would suggest you find a few shops that will let you experiment ('muck around') with faulty electronic units.

You could also try picking up some used units from wrecked cars, if they're not too dear. Pull them apart, and you'll soon get familiar with them.

Just remember my motto: if one man (or woman) made it, another can fix it. ❖

AUGUST BARGAINS FROM JAYCAR

NEW METEX M3650D COMPUTER INTERFACE DMM

NEW

This new model is the baby brother to the M3850 as shown in our catalogue. Features include: •dual display •RS232 interface •transistor •capacitance •auto hold •data hold •10 memory •bargraph •min/max display •relative offset •logic •20 amp •20mHz frequency. For further details see our 94 catalogue.

Option: •Computer Interface Kit Cat QM-1280 $18.95

Rubber holster: •Cat QM-1282 $19.95

Cat. QM-1240 ONLY $189.50

ALSO AVAILABLE M3850:

All the above features are included plus the following: •temperature •4000 count •back light •40mHz frequency •auto/manual range

Option: Temeprature Probe Cat QM-1282 $18.95

Cat QM-1260 $239.50

DIGITAL HYGROMETER

NEW

We sold these previously for $69.95. Now, we've found a new one, and have been able to reduce the price quite considerably and it has extra features!!! The unit has 2 digital LCD readouts with digits 12mm high. One measures Temperature from -15°C to +49.9°C with accuracy +/-1°C. The other measures relative humidity from 30% to 90% with accuracy +/-3%. It also has a min/max function. Pressing the min/max button displays the highest values since the unit was reset. You can now for example find out the highest temperature of the day in your office or the highest humidity in your bathroom. Press the button again gives you the lowest value. Unit can be hung up or will stand up by its tilting bail. Colour is white. Size 70(W) x 110(H) x 20(D)mm. Designed and developed in Germany.

Cat. QM-7200 ONLY $42.95

STORM CAR SUBWOOFER SYSTEM

NEW

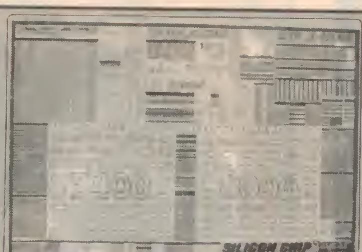
This amazing subwoofer should be in stock when you read these ads. It utilizes an 8" driver with a polypropolene laminated non pressed cone and high damping foam surround. It has a huge 30 ounce magnet and a 30mm Kapton voice coil. Its mounted in a tube 225 dia x 420mm long.

Specifications: •Power - 100WRMS •Freq resp - 60 to 3kHz •Impedance - 4 ohm •Efficiency - 88dB 1W/1M

Cat. CS-2295 $279 each

IT'S HERE!!!

JAYCAR / SILICON CHIP GIANT DATA WALLCHART



Includes data on:- •TTL •CMOS •transistors •Op amps •RAM •Voltage regulators •resistors •capacitors •heatsinks •wire gauges •meter shunts •Alcatel Cannon plugs •Din •RS232 •Centronics •Bus plus more

Cat. BC-6000 Folded $12.95 + $2 post

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NEW DIGITAL BLOOD PRESSURE MONITOR

SAVE $10

OSCILLOMETRIC METHOD

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Keep an eye on your blood pressure and save money with our new model. Features: •Measures: Systolic / Diastolic / Mean / Pulse •Kit includes: monitor cuff, record log, easy to follow instruction book. Specifications: •Display System: digital / LCD •Measuring Range: 20-280mm Hg (pressure) 40-200 pulses per minute (pulse) •Accuracy: +/-3mm HG or 2% (pressure) whichever higher +/-5% (pulse) •Pressurisation: manual pressurisation •Depressurisation: constant air-release valve system •Deflation: manual air release valve •Battery life: approx 6 months with 3 mins use per day

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TV / VIDEO / SPEAKER STANDS

Jaycar are proud to release a range of four metal stands that are suitable for TV's, videos, speakers etc.

TV Wall Bracket

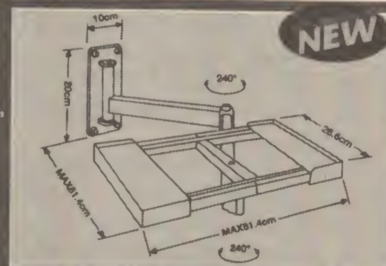
This bracket is suited to portable and smaller TV sets, PC monitors, small speakers etc. It revolves through 90° and tilts through 15°, so that the TV screen can be aimed directly at the viewer. Shelf width is 300mm, depth 280mm and maximum depth to wall with arm fully extended is 550mm. Finished in black epoxy polyestor powder coating. Load capacity is 30kgs.

NEW

Cat. CW-2810 $39.95

Large TV Wall Bracket

NEW



If you have a large TV and want to mount it on the wall, this is the bracket and it costs less than a wooden stand! Unit revolves through 240°, and has a maximum adjustable width of 814mm and depth 266mm. The maximum depth to wall is 814mm so it will accomodate even the largest of TV's. Finished in black epoxy polyestor powder coating. Load capacity 50kgs.

Cat. CW-2815 $89.95

TV Wall Bracket with VCR Shelf

NEW

Now you don't need to pay loads of money for a fancy TV/VCR wall unit. Simply mount them on the wall and use the space underneath for something else. The VCR shelf attaches firmly underneath the platform, so that both the TV and VCR controls are close together. Finished in black epoxy polyestor powder coating. The TV shelf expands width wise from 380mm to a massive 1150mm. Depth of shelf 260mm. VCR shelf expands from 350mm to 540mm. Load capacity is 50kgs.

Cat. CW-2830 $89.95

Speaker / Microwave Wall Bracket

NEW

This bracket will accomodate a large range of things including speakers, microwave ovens, clothes dryers etc. The shelf has an adjustable depth from 375mm to 570mm, wall bracket length is 420mm maximum. Again, finished in black. Load capacity is 31kgs.

Cat. CW-2820 $37.50

Computer Leads At Crazy Prices

TYPE & LENGTH	CONNECTORS	CAT NO	WAS	NOW	SAVE
Printer Lead - 2 m	D25 plug to Centronics	PL-0854	$12.95	$7.95	$5
Printer Lead - 5 m	D25 plug to Centronics	PL-0932	$15.95	$9.95	$6
D25 Serial - 2 m	D25 plug to D25 plug	PL-0856	$11.95	$7.95	$4
Serial Ext - 2m	D25 plug to D25 socket	PL-0855	$14.95	$9.95	$5
9 Pin Ext - 2 m	D9 plug to D9 socket	PL-0871	$12.95	$7.95	$5
VGA Ext - 2 m	D15 Hi D plug to socket	PL-0873	$14.95	$9.95	$5
Keyboard Ext - 2 m	5 pin Din plug to socket	PL-0874	$9.95	$6.95	$3
VGA Monitor - 1.2 m	D15 Hi D plug to plug	PL-0930	$9.95	$6.95	$3

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Centronics Gender Changer

MALE TO MALE - 36 PIN
Cat. PA-0894 $12.95
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D9/D25 Gender Changer Hood

Make up you own adaptor. Will accept 25D one side and 9D the other.
Cat. PM-0853 $2.95

SCSI Leads

SCSI DISK DRIVE CABLE
Consists of 3 x 50 pin IDC sockets on 18 inches of flat ribbon cable.
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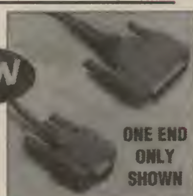
SCSI CABLE
50 pin Centronics plug to 50 pin Centronics plug. Length 2 metres.
Cat. PL-0934 $19.95

Laplink Cables



ONE END ONLY SHOWN

LAPLINK CABLE FOR PARALLEL PORT
D25 male to D25 male.
Cat. PL-0935 $12.95
RS232 LAPLINK CABLE
2 x DB9 female, 2 x DB25 female. Length is DB9 to DB25 - 300mm, DB25 to DB25 - 3 metres.
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This monitor filter features Anti-reflection and Anti-glare glass. It will cutout 100% of UV rays and helps to isolate X-rays. It will also enhance screen sharpness and contrast and cut daylight reflection. It is designed to work with 12-14" monitors and suits MGA, CGA, EGA, VGA and super VGA. Supplied with simple mounting hardware and a ground clip to stop dust buildup.
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3.5" DISKS CHEAPER AGAIN!!!

3.5" DSHD	NOW $9.95	Pkt 10	was $10.50	Cat XC-4738
3.5" DSHD-F	NOW $10.95	Pkt 10	was $12.50	Cat XC-4739

AMPLIFIED SPEAKER BARGAIN!

These speakers are designed to work with a Walkman or portable CD, or even your computer. We were offered a quantity of these & simply could not believe the price. They are about half what they should be. They look like something from the future, they are bright yellow in colour, and the top part where the speaker is can be tilted back and forward. Each unit requires 2 x AA batteries (not supplied). Power output is a huge 6 watts and the speaker diameter is about 80mm or 3".
They are very efficient, so there is a good volume level from a standard level input - better than most. Tonal quality is also very good.
The amplifiers can be switched off, & they can then be used as normal speakers.
Supplied with cable & 3.5mm stereo plug
Grab a pair while we have got them. Size: 135(H) x 100(W) x 75(D)mm.
Cat. AS-2965 Only $19.95 / pair

MOTOROLA PIEZO SUPER CAR TWEETER

Increase the top end of your car stereo system with absolutely no fuss. Piezos need no crossover, and put no impedance load on the amplifier, so you can simply connect them to any speaker leads. They are designed to be surface mounted & are supplied with base plate & mount instructions
SPECIFICATIONS: •Frequency response: 6kHz - 30kHz •Sensitivity: 88dB 1W/1M
•Impedance: Appears as 0.1µf capacitor
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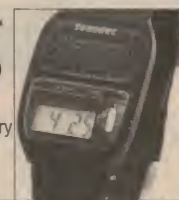
TALKING PRODUCTS

Up until now Talking Clocks and Watches have been rather expensive. We've found some quality ones and can offer them at well below what you would expect to pay.

Talking Alarm Clock

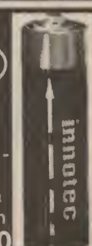
This clock has two time displays - one analogue and one digital. Both are separately adjustable, so they could be set for two different times, if you need to know the time in another part of the world. To hear the time, simply push the switch on the top, and the clock will speak the time very clearly. Other features include:
•chime function - clock can be set to say the time every hour if required •you have choice of alarm sounds - crow or "CO CO" •snooze function - the alarm will resound 10 minutes later up to 6 times. Size 150(H) x 130(W) x 70(D)mm. A perfect adittion to any room. Available in black or grey. Mail order customers please specify.
Cat. XC-0250 ONLY $24.95

Talking Watch



The Talking Watch will say the time at the push of a button. Ideal for anyone with impaired sight, or for using in dark places, or for fun for the kids. The watch will say the time every hour if required and it has an alarm. don't pay $29.95
Cat. XC-0240 ONLY $19.95

New Generation Rechargable AA Penlight Batteries - 1.2A/Hr



EVEN LARGER CURRENT THAN BEFORE. WAS 1.1AHR - NOW 1.2AHR. A 10% INCREASE IN CAPACITY FOR NO EXTRA CHARGE!
These new generation batteries are Ni-MH which is Nickel Metal - Hydride. Advantages of Ni-MH batteries: •Higher current capacity •No memory effect •Flat discharge curve •High drain performance •Recharge 14 hours@ 100mA •Capacity: 1200mAh
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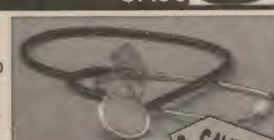
1/2 PRICE STETHOSCOPE



SAVE $10

We've now direct imported this and have been able to reduce our selling price by half! Quality Mars brand. Its accoustic response is remarkable. Unlimited uses, listen to your heart! Use with our blood pressure meter (shown elsewhere in these ads), even listen for nasty knocks in your engine.
Cat. QM-7255 Was $19.95 Only $9.95

SWANN ROCKER SWITCH PACK

SAVE A FORTUNE

SAVE A FORTUNE OVER NORMAL PRICE
The pack consists of a total of 23 switches. There are series 41, 50 and 51. All are 240VAC in currents 5, 10 and 15 amp. Switch configuration is mostly SPST. Colours are Beige, Grey, White and Black. They are commonly used in washing machines, fans radiators, dryers, air conditioners, toasters, lights etc etc. We purchased these from Swann as manufacturing overuns. To buy a single switch from a repair house you could pay up to $10 each or more. So grab a pack while we have them. LIMITED QTY.
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MADE IN USA — LIFETIME GUARANTEE

These boxes are made in the USA, have a Lifetime Guarantee and are TOUGH!!! They are made with rugged co-polymer construction.

SMALL: The small one has a unique component case mounted in the lid which has six compartments for holding tools and parts. The base is one large compartment. The box would make an ideal soldering/tool box for the hobbyist or computer user.
Total size 280(L) x 110(H) x 140(D)mm.
Height of base compartment - 60mm. Height of top component case - 35mm.
Has a clip to hold the unit closed and a snap out handle.

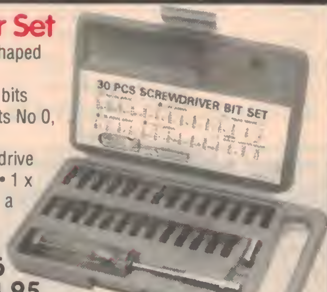
Cat. HB-6336 — ONLY $12.95

LARGE: This tool box is quality. It's built to last.
It has a tote tray inside, which is a tray with a handle to store tools like screwdrivers etc. It simply lifts out to reveal one large compartment which is the full size of the tool box. Size 90(D) x 370(L) x 170(W)mm. It has a nickel plated drawbolt and galvanised steel hinge pins which insure maximum load capacity. It can also be lockable.
The lid has a tongue and groove system, which helps to keep the water out. The box is so strong you can sit on it to eat your lunch.
Total size: 410(L) x 200(H) x 220(D)mm.

Cat. HB-6338 — ONLY $39.95

SAVE $$$ ON SCREWDRIVER KITS

30 Piece Engineer's Driver Set



This drivers set incorporates those obscure shaped heads! Here's what you get:
• 5 slotted bits 0-1, 3-4, 5-6, 8-10, 12 • 5 hex bits 3/32", 5/64", 7/64", 1/8", 9/64" • 4 Philips bits No 0, 1, 2 & 3 • 4 square recess bits No 0, 1, 2 & 3 • 6 Torx bits T10, T20, T25, T30, T40 • 2 Pozidrive bits No 1 & 2 • 1 x 1/4" drive socket adaptor • 1 x 1/4" drive hex bit holder And it's all housed in a sealable tough plastic case.

SAVE $4

Cat. TD-2000
was $18.95
now $14.95

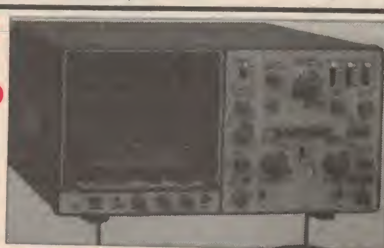
50 Piece Ratchet Screwdriver Socket Set

Here's what you get:-
• 4 slotted bits 5/32", 3/16", 1/4", 9/32" • 3 Phillips bits No 1, 2, 3 • 9 hex bits 1/16", 5/64", 3/32", 1/8", 9/64", 5/32", 3/16", 7/32", 1/4" • 3 Robertson bits No 1, 2, 3 • 2 Posidrive bits No 1, 2 • 7 Torx bits T10, T15, T20, T25, T27, T30, T40 • 4 1/4" Star sockets E5, E6, E7, E8 • 7 metric sockets 6mm, 7mm, 8mm, 9mm, 10mm, 11mm, 12mm • 7 imperial sockets 3/16", 1/4", 5/16", 11/32", 3/8", 7/16", 1/2" • 1 x 1/4" drive socket adaptor • 1 x 4" extension bar • Ratchet driver
And all this lot is housed in a tough durable metal case.

SAVE $7

Cat. TD-2002 — was $31.95 now $24.95

OUR 25MHZ CRO IS NOW EVEN BETTER! NOW WITH DELAYED SWEEP!!



There are five ranges of delayed sweep (1mS-10µS, 10µS-100µS, 100µS-1mS, 1mS-10mS, 10mS-100mS). The delay time has a continuous fire 20 turn control also. All other features remain the same. See 1994 catalogue for full details - page 33.

NEW

Cat. QC-1900 — $729.00

NEW TOOLS NEW TOOLS

TAMPER PROOF STAR SCREW BIT SET

NEW

Finally available at a reasonable price. The set consists of 7 Tamper Proof Star pieces which fit the 6 point STAR type screws with tamper proof pins, as those found on computer systems etc. They are T10, T15, T20, T25, T27, T30, T40. We used to sell the one T20 for $9.95. Now you can buy the whole set for not much more! Made from chrome vanadium - steel and heat treated.

Cat. TD-2034 — A BARGAIN At Only $14.95

TAMPER PROOF STAR SCREW SOCKET SET

NEW

This set includes 11 different sizes of tamper proof star pieces, 6 with 1/4" drive sockets and 5 larger ones with 3/8" drive sockets.
They are: •T10, T15, T20, T25, T27, T30 with 1/4" drive sockets •T40, T45, T50, T55, T60 with 3/8" drive sockets. The larger sizes are now used in late model motor cars.

Cat. TD-2038 — $29.95

COMBINATION CIRCLIP PLIERS

NEW

This unique new tool comes with four interchangable heads. These different "heads" enable the tool to grasp circlips both externally and internally for easy mounting and removal. Each head can be used for both external and internal grasping, depending on how it is mounted. The heads supplied are 45° tip angle, 90° and two 180°.
The tool is suitable for circlips with a diameter of between 10 and 50mm (3/8" to 2"). An extremely useful tool for the serviceman and anybody who works with equipment using circlips.

Cat. TH-1920 — $24.95

"POCKE" TORCH

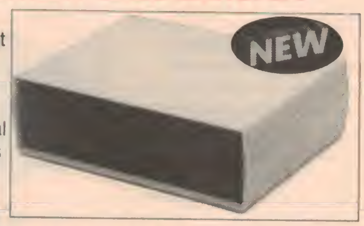
PIEZO ELECTRONIC WINDPROOF BURNER

NEW

Turn a common disposable cigarette lighter into a blowtorch. Ideal for soldering, braising or simply turning a cigarette lighter into a windproof burner.
Its one hand operated and uses a piezo ignition starter which ensures instant start every time. Ideal for •lighting fires •barbeques •lanterns •sterilization •pipe lighting outdoors •waxing and soldering •braising •silver soldering etc. Supplied with cigarette lighter.

Cat. TS-1680 — $29.95

PRO QUALITY INSTRUMENT CASE BARGAIN



This case is almost identical to the medium size case Cat HB5912 (1994 cat page 73) except that its about 1.5mm lower in height and they are mustard in colour rather than grey. Front and rear panels are black. These include: •internal mounting posts for PCB's, transformers etc •PCB guide rails •removable front and rear panels •top and bottom split apart •great for test equipment. Overall size - 205(W) x 64(H) x 157(D)mm. OUR GREY ONES SELL FOR $16.95

Cat. HB-5911 — These Are Only $8.95ea

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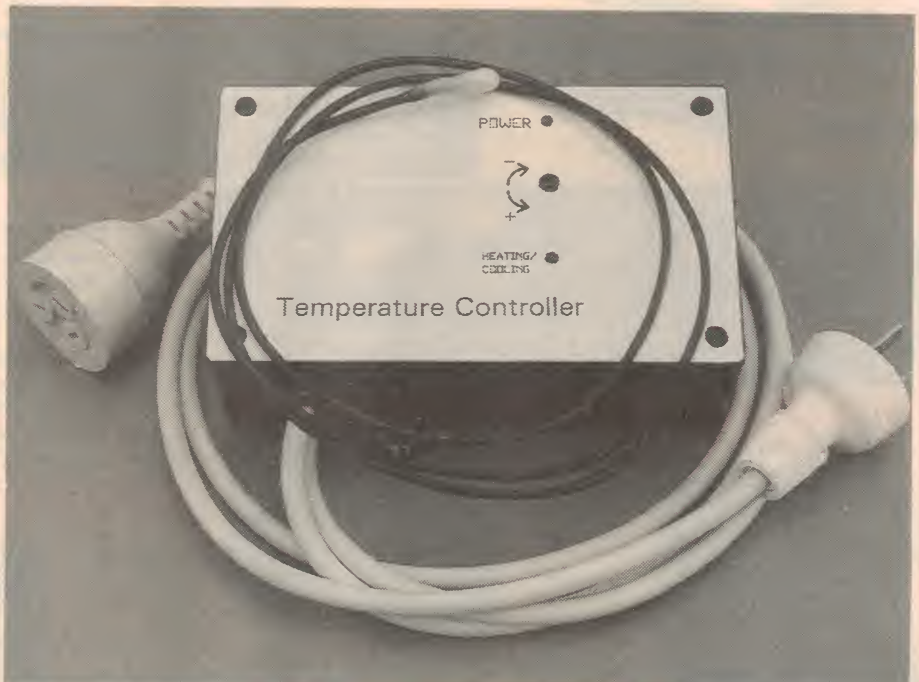
Construction Project:

Budget priced Temperature Control

This handy and compact unit can switch 10 amps at 240V AC under the control of a temperature sensor — and it's budget-priced. The temperature setting must be calibrated manually, but can be set from sub-zero temperatures, to around 100 degrees Celsius or more. A PCB jumper allows the unit to be set to switch the circuit's relay either on or off when the desired temperature is exceeded.

by GLENN PURE



This project relies on a thermistor as a temperature sensor and a simple, low cost circuit to monitor it. The thermistor is mounted on the end of a cable for remote temperature sensing.

I've built a number of these units in the past, and have found them very reliable and useful for applications such as thermostats for home brewing and an orchid terrarium. The circuit could also be used as an alarm for over-temperature or under-temperature, by using the relay to switch a buzzer rather than 240V.

Thermistors

First a little bit about thermistors. These devices are simply resistors whose impedance changes substantially with temperature. There are two types — the negative temp- erature coefficient (NTC) variety and the less common positive temperature coefficient (PTC) versions. As the titles suggest, the impedance of NTC thermistors falls as they get hotter while the reverse is true for PTC types.

Thermistors come in a selection of nominal impedances — ranging from a few thousand ohms, or less, to a megaohm or more. The NTC thermistor used in the prototype of this project has a nominal impedance of 10k ohms (at 25°C) and shows a drop in impedance of almost 5% for every increase in temperature of one degree Celsius — which is fairly typical. Even though I have used a particular thermistor in the prototype, most NTC thermistors should work in the circuit presented here. Advice on where you can get thermistors is in the parts list.

Circuit description

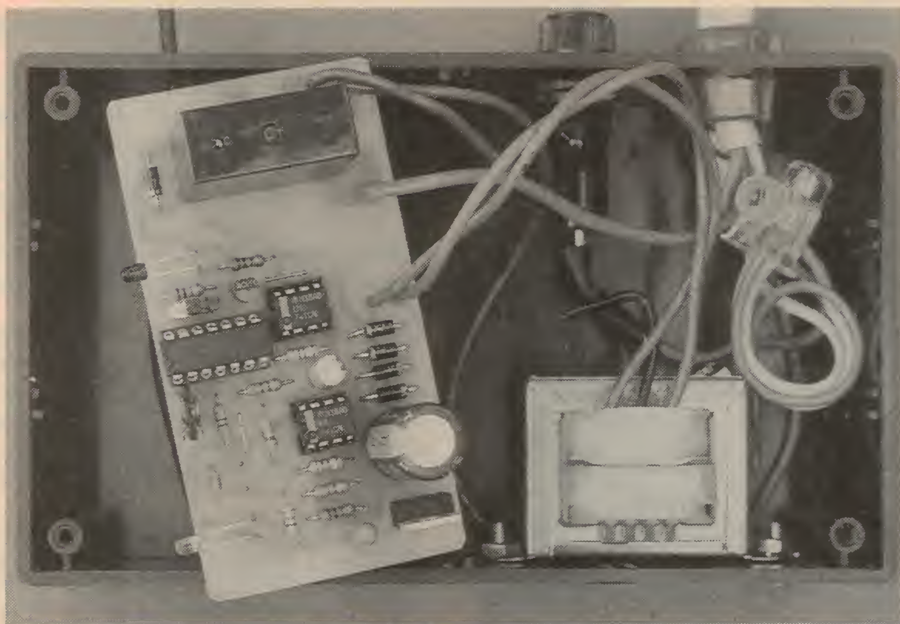
Fig.1 shows the circuit diagram. The thermistor is basically connected in series with a trimpot (VR1) to form a variable voltage divider. The voltage produced at the junction of the thermistor and the trimpot is compared to a known, voltage produced at the junction of fixed resistors R1 and R4.

R1 and R4 simply form another resistive divider and since they have the same impedance, the voltage at their junction is 6V (half of the 12V supply voltage). However, the fact that 6V was chosen as the reference voltage is quite arbitrary.

The voltage comparison is done by an operational amplifier comparator. I won't go into much detail about comparators here as previous articles and projects in *EA* have this well covered (for example, there is a good description in the Exhaust Gas Oxygen Sensor project — see the February 1994 issue).

A common, 'garden-variety' 741 operational amplifier (U1) is used as the comparator, whose output primarily controls whether the relay is open or closed — but more about control of the relay a little later. The reference 6V produced by R1 and R4 is connected to the inverting input of U1 and the variable voltage produced by the thermistor/pot pair goes to the non-inverting input.

When the voltage present at the thermistor/pot junction *exceeds* the 6V reference (which will result if the temperature of the thermistor is below the set temperature), the output of U1 (pin 6) goes high (near 12V). Likewise, the output of U1 goes low (near 0V) when the



An inside view of the controller, with the PCB removed and laid out flat for clarity. Note that the heatsink on voltage regulator U3 has been removed for a better view of the PCB.

Two types of thermistors: a glass bead type, as used in the prototype for this project and a disc type. Both of these and other NTC thermistors will work in the circuit.

thermistor/pot junction voltage falls below 6V.

VR1 controls the temperature at which the relay switches on or off. When the impedance of the thermistor and VR1 are the same, the relay will be at its switching point.

In practical terms, this means for that if you wanted to set the relay to switch at say 25°C, you would hold the thermistor at 25° (allowing a minute or two to stabilise), then adjust VR1 until the relay is at the point where it's just switching on or off (indicated by the red LED or the audible 'click' of the relay contacts). VR1 should be changed in small increments, allowing a few seconds between each change as the circuit takes a few seconds to respond to any change in setting.

At this point, it's worth commenting on the use of different NTC thermistors in the circuit. These can easily be accommodated simply by changing VR1. In general, the trimpot should be about double the impedance of the thermistor at 25°C, unless you plan to use your temperature controller at some extreme hot or cold temperature.

For example, in the prototype, VR1 is a 22k trimpot which is about twice the value of the thermistor (10k) at 25°C. This allows the controller to be set at a wide range of temperatures around 25° — in fact from about 6°C to possibly 60 or 70° — at the upper end, it will become difficult to accurately set the trimpot to the low resistance required for higher temperatures.

Ultimately, the useable range of temperatures will only extend as far as the manufacturer's specified limits of the thermistor. For the one used in the prototype, the lower limit will be about minus 40 - 50°C. The upper physical limit will depend on both the thermistor and its connection wire. Again for the one used here, the upper limit may be about 100°C or more. (The thermistor used in the prototype is actually rated to 200° at zero power and 55° at full power of 60mW. Since the circuit runs the thermistor at 10 - 15mW, the upper limit will be significantly below 200°.)

The circuit also includes two 4.7k resistors, one between the thermistor and ground, and the other between VR1 and the 12V supply. The purpose of these two resistors is to limit the current flowing, especially through the thermistor. This is particularly important for thermistors with low nominal impedances say 2k to 10k.

At higher temperatures, without limit-

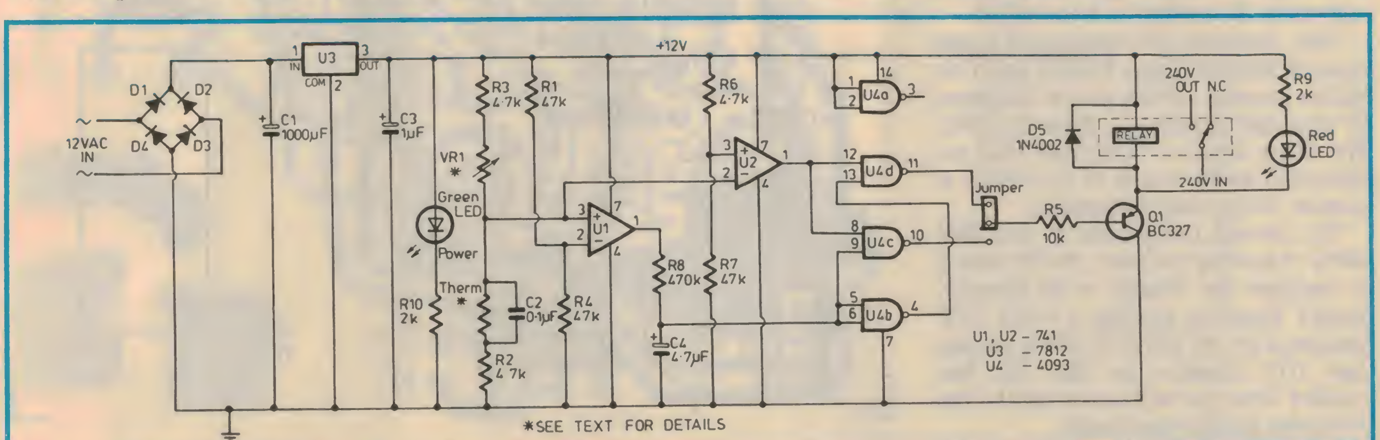
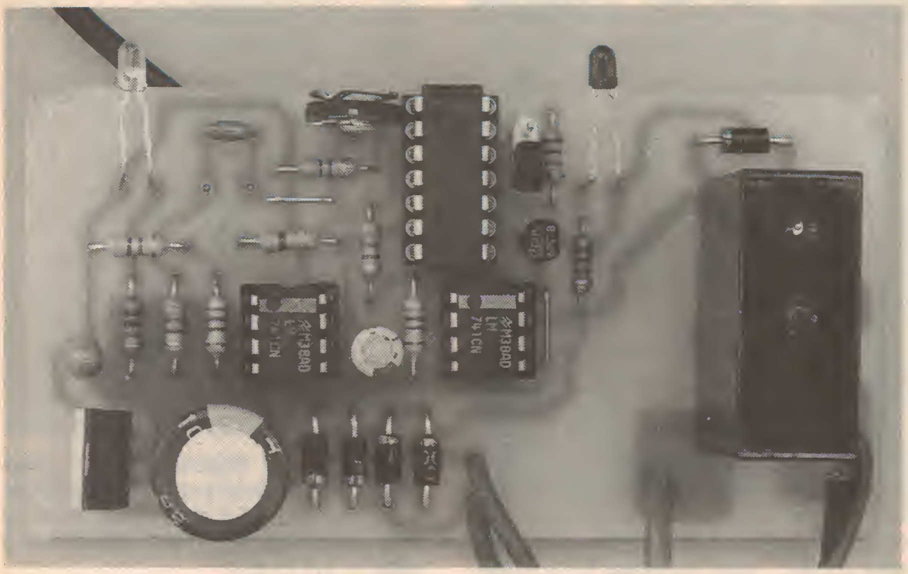


Fig.1: The schematic for the controller. The resistance of the thermistor, which varies with temperature, is compared with resistor R1 by comparator U1. The output of U1 is then filtered and gated before being used to drive the relay.

Budget priced temperature control



A close up view of the PCB. The heatsink on the voltage regulator U3 has again been removed for clarity.

ing resistors, the thermistor can actually conduct sufficient current to heat itself up. At best, this makes it useless as a temperature sensor and at worst, it could destroy it.

Back to the output of U1. This is first conditioned by R8 and C4, which act to dampen, by a few seconds, any rapid swings in output voltage. This is important especially for slow response thermistors, such as the disc type sold by Dick Smith Electronics.

These thermistors change impedance sufficiently slowly that they can cause the output of U1 to oscillate high and low for a second or two at the switching point. If this signal was fed directly to the relay coil without the buffering provided by R8 and C4, it would cause the relay to 'buzz' open and closed repeatedly. Something to be avoided!

After buffering, the signal goes to one input of Schmitt trigger NAND gate U4c and an inverted version goes to one input of U4d (the inverting is done by U4b). The other inputs of U4c and U4d are connected to the output of U2, which is another 741 op amp comparator.

This second comparator is provided solely as a safety measure. Its function is to compare the voltage at the thermistor/pot junction against a fixed 10V (produced by R6 and R7). If it is greater than 10V, chances are that this has resulted from the wire connected to the thermistor going open circuit.

Under such conditions the output of U2 will go low and the outputs of U4c and U4d will always be high, switching Q1 off and ensuring the relay is never activated.

Under normal conditions, the output of U2 will be high and the outputs of U4c and U4d will be solely determined by the buffered output voltage of U1 — which you will recall is controlled by whether the thermistor is above or below the set temperature.

A 'pin header' jumper is provided to select one of these outputs for connection to the base of Q1, via series resistor R5. When Q1's base is grounded (low), it conducts current from the relay coil and causes the '240V out' relay contact to be connected to the '240V in' contact. Q1 also drives a red indicator LED, which provides a convenient indicator of the state of the relay.

The PCB has 'Cool' and 'Heat' markings at opposite ends of the three-pin jumper header. When the pin closest to 'Cool' is shorted with the centre pin, it results in connection of U4c to the base of Q1. Under these conditions, the relay contact closes when the set temperature is *exceeded.* The reverse is true for the 'Heat' setting.

The 4093 CMOS gate (U4) was chosen as the final relay control stage, because of its Schmitt inputs. The conditioned output of U1 rises and falls slowly, making a Schmitt input gate essential to achieve a sharp, non-oscillating output.

The power for the circuit is supplied by a mains transformer with a secondary of 6.3V-0-6.3V. Mine came from Dick Smith Electronics, but all of the major component suppliers stock an equivalent.

A full wave bridge and a 7812 regulator convert the 12V AC to 12V DC. A small heatsink is desirable on the regulator (U3) as it will dissipate some heat when the relay coil is conducting.

Construction

The project is assembled in a standard 150 x 90 x 50mm jiffy box. The PCB is designed to slide directly into one of the slots provided inside these boxes.

All of the components, except the fuse, transformer and thermistor mount on the single PCB. The overlay is shown in Fig.2. Note there are two wire links on the PCB — one between U2 and R9 and one between R3 and R8.

The two LEDs are mounted at a right angle to the PCB, so they will just poke through suitably-sized holes in the lid of

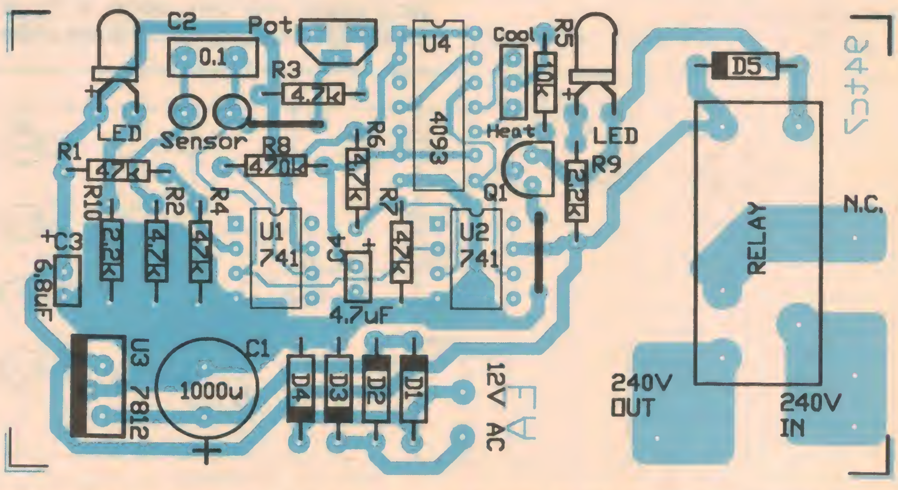
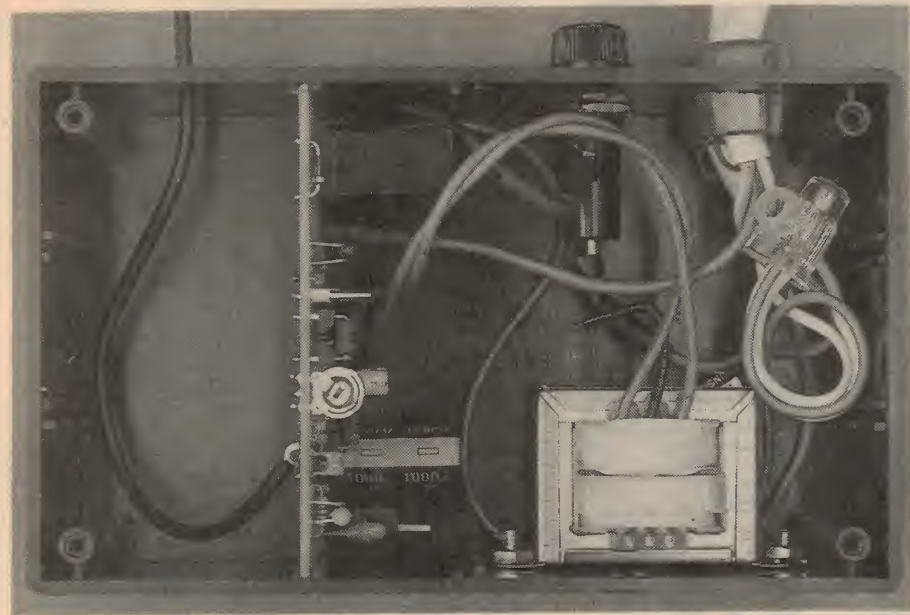


Fig.2: Use this overlay diagram to guide you in wiring up the temperature controller PCB. Note the two wire links, as well as the three pin header strip and jumper.



This inside view of the controller shows the PCB positioned in one of the slots in the jiffy box.

the jiffy box. The holes in the lid artwork are centred about 6mm to one side of the PCB so you will need to bend the LED leads and mount them accordingly. A hole is provided in the lid, between the two LEDs, for access to VR1, used for adjusting the switching temperature.

The thermistor is mounted on the end of a suitable length of shielded audio cable, by soldering. It is advisable to then pot the thermistor and the cable end with some epoxy resin to fully enclose and seal it.

Take great care to ensure the mains wiring is correct. Fig.3 shows the correct way to do this. Note that the low voltage connection from the transformer secondary to the PCB is not shown in this diagram.

For the mains wiring, I used an inexpensive commercially manufactured mains extension lead of suitable length. Simply cut the lead at an appropriate point and feed the cut ends into the box for connection.

Make sure you secure these cables to the box with cable clips to ensure they can't be accidentally pulled out. For the 'do it yourself' enthusiasts, Figs.4 and 5 show the PCB artwork and the lid artwork actual size.

The relay

Before finishing, it's worth making a few comments about the relay. The one specified for the project has contacts rated at 10A, 240V AC and is a single pole, double throw type. This means that there are two relay outputs — one that is normally closed when the relay coil is not energised and one which is open. These states switch when the coil is energised.

A pad is provided for connection to the normally closed contact (marked NC on the PCB overlay) for those who might wish to use it. However, it is not used in the circuit described here.

Fortunately, equivalent relays, with identical pinouts and contact ratings are available from each of the major kit suppliers. Details can be found in the parts list. Note that the relay from Dick Smith Electronics (catalog P-8010) is listed as having 5A contacts in their catalog.

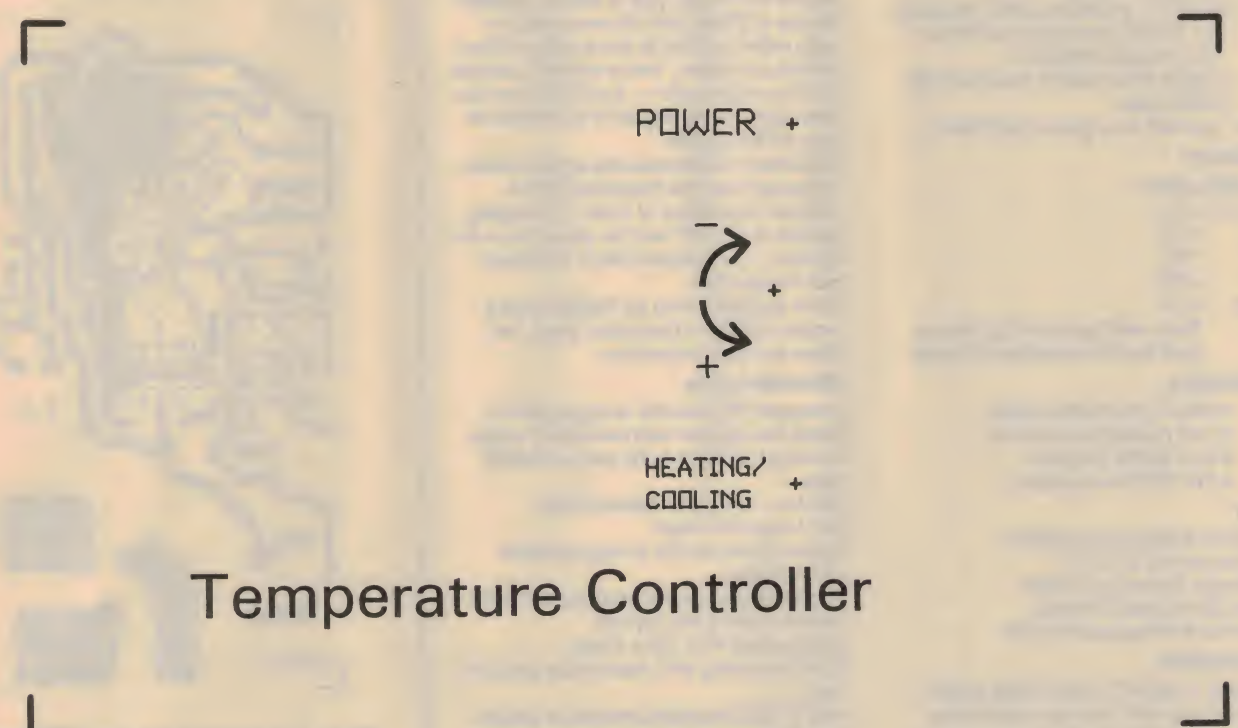


Fig.5: Here is the artwork for the controller front panel, actual size for those who would like to duplicate the prototype.

Budget priced temperature control

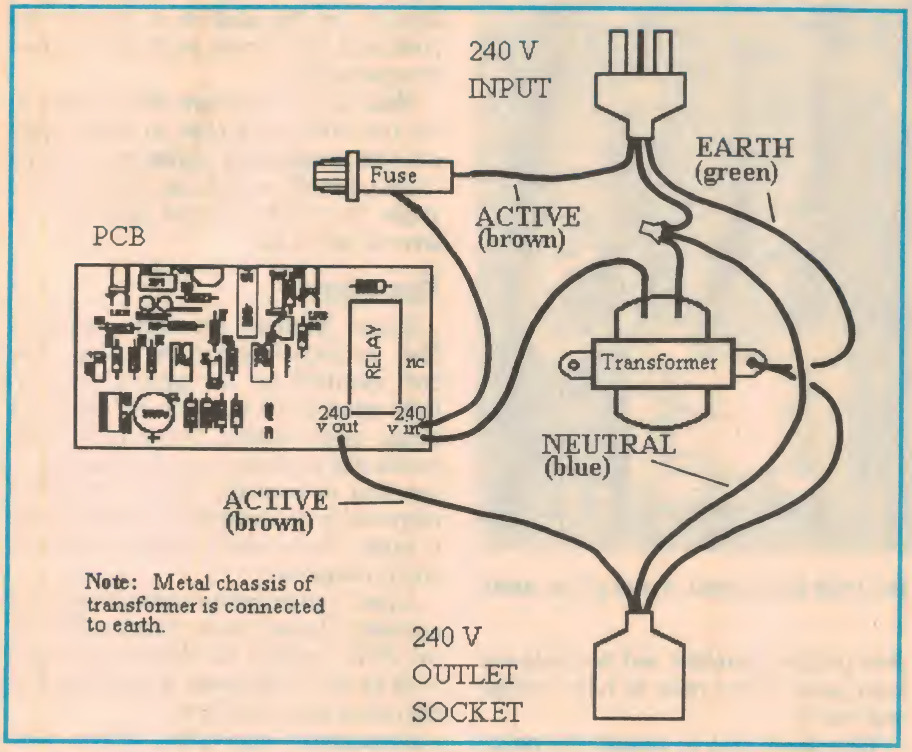


Fig.3: Details of the mains wiring. Note that the low voltage secondary output lines from the transformer are not shown here.

PARTS LIST

Semiconductors

D1-5 1N4002 or similar
Q1 BC327 or equivalent PNP transistor
U1-2 741 CMOS operational amplifier
U3 7812 voltage regulator
U4 CMOS 4093 quad 2 input Schmitt NAND gate
LEDs One red, one green (both 3mm)

Resistors

All 1/4W carbon:
R1,2,4,7 47k
R3,6 4.7k
R5 10k
R8 470k
R9,10 2.2k
VR1 5mm vertical mounting trimpot (see text for selection of value)

Capacitors

C1 1000uF 25VW electrolytic
C2 0.1uF monolythic ceramic
C3 6.8uF 25VW tantalum
C4 4.7uF 25VW electrolytic

Relay

Any of the following is suitable:
Altronics cat no. S-4170
Dick Smith Electrnics P-8010
Jaycar Electronics SY-4050
Rod Irving Electronics S-14114

Thermistors

As noted, most NTC thermistors should work in this circuit. The one used in the prototype is a high quality, fast response, miniature glass bead type from Melbourne surplus parts reseller Vorlac Industries (phone (03) 562 8559; fax (03) 562 8772), who indicate they have plenty in stock. The Vorlac catalog number is Z-4200 and price is 0.30 each, plus a one-off postage charge of $3.50 (A$4.50 overseas) for each order (no limit to the number of thermistors per order). Vorlac normally charge $7.00 p+p per order — the $3.50 p+p has been specially arranged for thermistor orders for this project.

Dick Smith Electronics also sells a slower response disc-type thermistor with a nominal impedance of 100k. The catalog number is R-1797 and the price just under $2 each. I have tested this in the circuit and it works fine.

Other suppliers such as Farnell have a range of different thermistor types, but some are quite expensive.

Miscellaneous

Three-pin PCB header and jumper link
Mains transformer with secondary output of 150mA, 6.3V- 0-6.3V, plus mounting bolts
Jiffy box: 150 x 90 x 50mm (UB1)
240V extension lead
Screw connector (for joining the 240V neutral wires)
Two cable clamps, for securing the 240V cables entering the jiffy box
Single-sided PCB, 89 x 47mm
Panel-mounting 3AG fuse holder and 10A fuse
Mini TO-220 heatsink and bolt to secure
Length of coaxial cable for connection to the thermistor
(Optional: IC sockets, two 8-pin and one 14-pin)

However, this is apparently the rating for switching inductive loads (such as electric motors found in air conditioners). The data sheet kindly provided by DSE shows the contacts have a rating of 10A at 240V AC when switching purely resistive loads (like bar heaters etc).

On the subject of contact ratings of the relay, you can generally assume that the rating for switching inductive loads will be about half that for resistive loads. Take care not to exceed the appropriate rating for the type of load you plan to switch.

Don't forget, also, that the relay will eventually wear out, but it will do a lot of work before it does. The data provided on the Dick Smith Electronics relay is probably indicative: these are rated at 100,000 closures at maximum resistive load. After 200,000 closures however, the contact rating falls to about 6A at 240V AC.

All of the relays listed in the parts list have a coil impedance of around 280 ohms (despite contrary information in some component sellers' catalogs). Should you decided to substitute a different relay for the ones recommended here, ensure that the transistor driving the relay, Q1, can handle the power and current required. I have specified a BC327 in the circuit which can dissipate about 0.8W. ❖

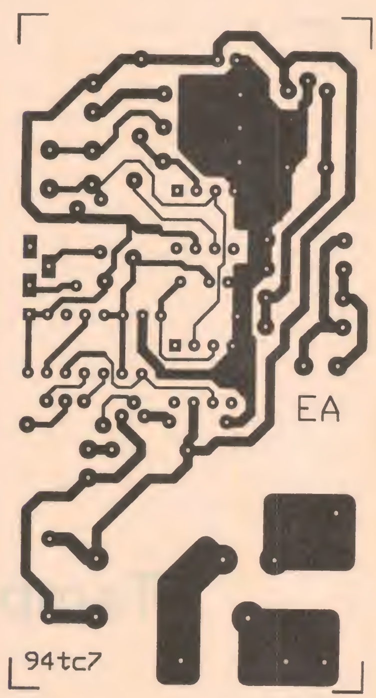


Fig.4: The artwork for the temperature controller PCB, reproduced here actual size as usual for those who like to etch their own boards.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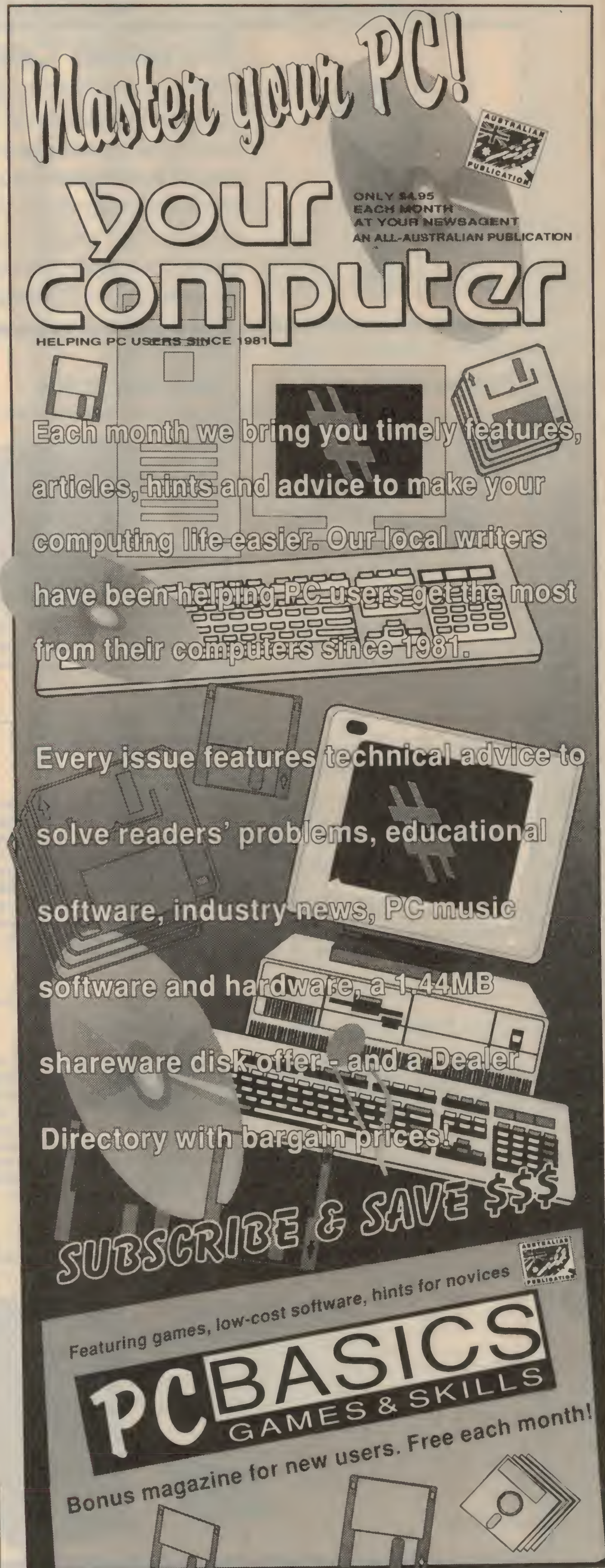
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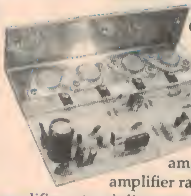
Regards Jack O'Donnell

200W Mosfet Amp Module Kit

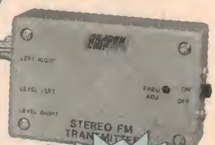


(See EA Dec '89) One mono module - no power supply or case. Fantastic for use in stage amps, Juke boxes, amplifier racks (multi-amplifier setups) discos etc. Requires ±69V DC power supply.

Specifications:
Output Power:.....140W RMS into 8Ω
200W RMS into 4Ω
Power Supply:.....±69V DC
Distortion:............0.007% @ 140W

K 5170 **$85.00**

FM Stereo Transmitter Kit

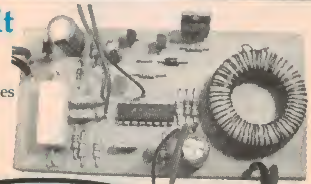


(See SC Oct '88) Simply connect your CD player or any other line level source to the mini transmitter which converts the audio signal to an FM signal. This FM signal can then be tuned in via any FM radio. Great for listening to your favourite CD while washing the car, mowing the lawn or doing the vacuuming etc, without blasting the neighbours.

Turn Your CD Player Into a Mini FM Transmitter!

K 1120 **$34.95**

Nicad Fast Charger Kit



(See SC May '94) This kit will allow you to charge your nicads in a very short time. 50 minutes for 600Ah 'AA' and about 100 Minutes for 1.2 AH 'C' & 'D' cells. It can be powered from your car battery, or any other 12V DC source. Can be configured to charge 2 or 4 batteries at a time. Includes a built-in timer circuit to prevent over charging and utilises a switching controller to create a high efficiency charge.

Charge up to 4 AA Nicads in Less than 1 Hour! Ideal for Remote Controlled Car Enthusiasts etc.

NEW

K 1665 **$49.95**

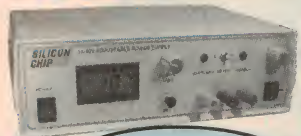
200W Switch Mode Inverter Kit

(See SC Feb '94) This compact 200W Inverter can drive many mains power appliances including power tools, fluorescent and incandescent lights, TV's etc, using a 12V power source. It is ideal when camping, on building sites, on farms or as part of a solar power installation. This inverter, uses high frequency switching techniques which eliminates the need for bulky, heavy transformers enabling a very light weight compact unit.

Features: • Small physical size • Very low standby current • Modified square wave output • Peak-peak voltage equal to mains sine wave • Low battery voltage shutdown • 30A - over current limiting • Fuse protection • Fully isolated output for safety • 2kg mass

K 6740 **$199.00**

40 Volt 3 Amp Variable Power Supply Kit

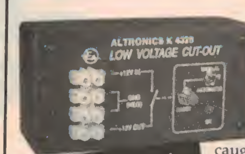


Includes LCD Digital Display for Precise Measurement!

(See SC Jan/Feb '94) This 1.23 V to 40 V adjustable power supply is designed for heavy-duty work. It uses a high efficiency switching regulator circuit. Features preset voltage and current limiting, full overload protection (with indicators) and an LCD panel meter for precise voltage and current readouts. Includes pre-punched front and rear panels. Professionally screen printed front panel, all housed in a sturdy instrument case.

K 3330 **$239.95**

Low Voltage Cut-Out for Cars and Boats Kit

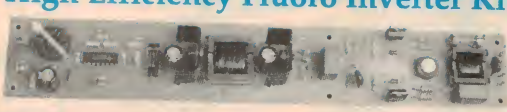


(See SC Jan '92) Build this simple little device, and avoid getting caught out with a flat battery during your holidays. It simply connects into a 12V accessories power line, and shuts off the flow if the battery voltage drops to a dangerously low level. Ideal for battery powered camping fridges etc.

Adjustable Cutout Variable from 10.9V to 11.9V. Includes Automatic or Manual Voltage Reset Function.

K 4328 **$24.95**

High Efficiency Fluoro Inverter Kit



(See SC Nov '93) Great for camping or working on the car at night. This nifty circuit will drive a standard 40 Watt fluoro tube from a 12 volt source. Fluoro lights, are miles more efficient than incandescent globes. Features flicker free starting/running, reverse polarity protection and faulty tube protection circuitry. Globe and housing not included. Requires 11 to 14V DC power source. Suitable for 18, 20 36 and 40W globes. Fuse protected for reverse polarity or faulty tube. Low EMF radiation.

K 6370 **$49.95**

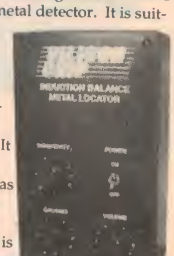
Simple Driver Kit For Servo Motors

(See SC May '94) If you have ever wanted to experiment with servo motors but not known where to start, then this kit is for you. Servo motors are used in remote controlled cars, planes, remote mirrors etc. The article explains servos and how they are driven. The kit can be used to either test or direct control servos where a radio link is not required. It is a simple circuit to construct with minimal components.

NEW

K 6050 **$16.45**

Induction Balance Metal Detector Kit



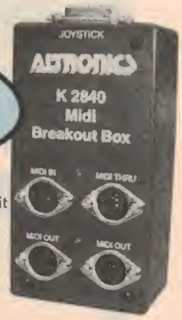
(See SC May '94) What a great kit. This is a simple to build metal detector. It is suitable for wet & dry ground, includes adjustments to eliminate ground effects, has a sensitivity control and audible indicator. It can detect a small metal objects such as a coin at a distance of about 20cm. Please note this kit is supplied in short form. i.e. does not include PVC piping (standard electrical or plumbing pipe available from hardware stores) nor the plastic plate for the coils.

Find Lost Jewellry, Coins etc!

NEW

K 1250 **$59.95**

Midi Breakout Box Kit



(See EA Feb '94) To make use of the Midi facilities on your "Soundblaster" card on your PC you will require a breakout box. This kit plugs into the joystick port of the Soundblaster card and gives 2 midi out ports, 1 midi in and 1 midi though port. Included is a pass through socket which allows a joystick to remain attached. The kit is fitted with the standard 5 pin din sockets. Does not include synthesiser software required.

Run Midi Equipment Through Your Soundblaster Card in a IBM Compatible Personal Computer

NEW

K 2840 **$34.95**

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Ugly is Only Skin Deep!

Stony Broke Speakers by REDBACK™

As featured in SC Magazine June '94. This speaker kit is a bit like the Volkswagon; not too pretty to look at but performs superbly. Well that's the same as the Stony Broke speakers; pretty ugly but sounds sensational. Frankly, the reproduction from these speakers must be heard to be believed. They sound simply amazing. Ideal for bookshelf speakers, extension speakers or speakers for personal walkman type systems. Comes supplied in kit form. The kit for each speaker consists of two large jiffy boxes, one C 0629 30 Watt driver, one C 3010 tweeter, crossover, innerbond wadding, port tube, spring loaded terminals, 6 metres of cable, all fixing screws etc. In fact all you will need is a tube of silicon or similar to seal the 2 boxes together. The main speaker holes have been machined, all you will have to do is drill the mounting holes for the speakers. No special tools are required. Basically all you will need is a screwdriver, soldering iron, drill with 3mm drill bit, cutters etc. Even though these are a low cost kit, there has been a considerable amount of engineering to achieve the resultant sound! The main speaker driver complimented with the tuned enclosure exhibits quite amazing bottom end for a speaker this size.

Stony Broke Looks Ugly Sounds Sensational!

"These have no right to sound as good as they do!"
Leo Simpson,
Silicon Chip Magazine.

C 3200 Only **$89.95** per pair

Professional Series Instrument Cases

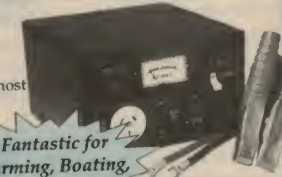
As a result of a massive scoop purchase, Altronics can now offer these fantastic cases to you at rock bottom prices!

Lightweight and Compact
As used in many EA and SC kit projects and by many major manufactures Australia wide, these instrument cases are moulded from ABS plastic and feature internal mounting posts, PCB guide rails and ventilation slots. Attractive textured finish, with removable front and rear panels. Complete with rubber feet
Dimensions - 250W x 190D x 80H mm
H 0482 Light grey
H 0483 Black
Normally $20.85 ea, **This Month Only $14.50 each**

Give Your Project that Extra Professional Finish!

300 Watt Inverter

This nifty inverter converts 12 Volts DC to 240 Volts AC. Includes an on/off switch and a light & heavy load switch with metered output. Works well with most electrical equipment. Includes heavy duty battery leads to connect directly to your battery.



M 8120 NORMALLY $249.00 **Save $50**
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Fantastic for Farming, Boating, Camping etc.

Aviation Headset

1000's Sold Across Australia-Includes 2 Year Warranty!
It was not to long ago when spending $450.00 on an Aviation Headset was not uncommon. Altronics changed all that when we released our C 9070 Aviation Headset for $199.00. Now with the edition of the flexible boom unit and helicopter version (fitted with a Nato plug) our headsets have gone from strength to strength. Add to this enhanced microphone, improved lead shielding and headband comfort these headsets must be the best value for money in Australia!

C 9070 Standard Model **$199.00**
C 9073 New Flexible Boom Model **$225.00**
C 9072 New Helicopter Model **$249.00**

This Month Receive a FREE Carry Case Valued at $19.95

In-Line RS-232 Breakout Box

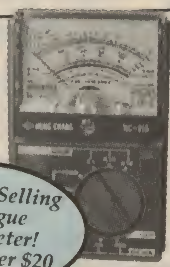
Designed for circuit testing, mounting and patching. It has 10 signal powered LED's, as well as 2 spares to indicate which lines are in use at any one time. It also has 24 switches as well as jumper leads to allow you to breakout circuits or re-configure and patch all of the 24 active lines.
D 1540 Normally $89.95,
This Month Only **$69.95**

Ideal for Testing & Designing Computer Wiring etc!

Budget Pocket Multimeter

2000 Ohms-Volt sensitivity. Overload protected. Mirror back scale helps prevent parallax error. Complete with test leads and instructions. Uses 1 x AA Battery (supplied).

Specifications:
DC Voltage Ranges:..........10V, 50V, 250V, 1000V
AC Voltage Ranges:..........10V, 50V, 250V, 500V
Decibels:............................10 to 22dB
DC Current Ranges:..........0.5mA, 50mA, 250mA
Resistance Ranges:...........Rx1, Rx10, Rx1k



Our Best Selling Analogue Multimeter! Now Under $20

Q 1013 Normally $21.95, This Month **$17.95**

CADIK Micro Jet Gas Blow Torch

Powered by a common disposable type gas lighter (not supplied), this unique blow torch burns at 1300°C, making it ideal for all types of braising and heavy duty soldering. With it's ergonomic design, the Micro Jet can be ignited and used simply with one hand. It has an in-built piezo electronic ignition system which ensures easy lighting every time. Ideal for the workshop, tool box, work bench etc. Suitable for Heavy Duty Soldering, Braising, Silver Soldering, hobbies, Model Construction etc.

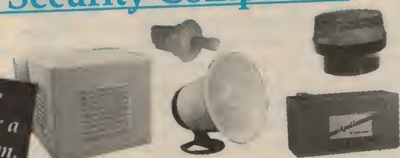
As Reviewed by Silicon Chip Magazine May '94

T 2490 **$29.95**

Quality Alarm Systems as Used by Security Companies

Protect Your Home or Business from Intruders with One of these 'State of the Art' Burglar Alarm Systems

Both Systems Include Everything you Need for a Complete Security System. Even Cable!



Additional S 5302 PIR Movement Detectors $69.95

Deluxe Security System - Package 1

Everything you require for your home or office, even the cable! This package includes are deluxe S 5485 4 sector alarm panel. It features a user selectable 4 digit pin number allowing you to arm and disarm the alarm via the inbuilt digital keypad. 4 independent sectors accept almost any type of sensor (Normally Open and Normally Closed). Any sector can be individually isolated, (e.g. when at home you may want to turn on perimeter sensors, allowing movement inside). Includes a 24 hour panic and tamper sector. Alarm pre-warning reminds you to disarm on entry. Constructed in sturdy steel case with lock. Includes easy to follow installation instructions.

Package 1 Includes:
• S 5485 Alarm Panel • S 5065 1.2Ah Battery Backup • M 9027 Plug Pack • C 2015 External Siren • S 5460 Siren Cover • S 5445 Strobe • 1 x S 5302 PIR Movement Detector • S 5160 Tamper Switch • 1 x S 5153 Reed Switch • W 0303 200m 6 Core Cable

Normal Value of $657.90
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Includes FREE 200m Roll of 6 Core Cable!

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This package includes the S 5480 3 sector alarm panel. It features an inbuilt keyswitch allowing you to arm and disarm the alarm. 3 independent sectors accept almost any type of sensor (Normally Open and Normally Closed). Includes a 24 hour panic and tamper sector. Constructed in sturdy steel case with lock. Includes easy to follow installation instructions.

Package 2 Includes:
• S 5480 Alarm Panel • S 5065 1.2Ah Battery Backup • M 9027 Plug Pack • C 2015 External Siren • S 5460 Siren Cover • S 5445 Strobe • 1 x S 5302 PIR Movement Detector • S 5160 Tamper Switch • 1 x S 5153 Reed Switch • W 0302 200m 4 Core Cable

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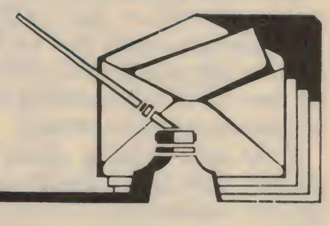


Conducted by Peter Phillips

Charging and discharging batteries...

Our first topic this month is the controversial one of charging dry cells, followed by discussion on the best way to discharge NiCads. We also have a brief foray into speaker design, and a look at some of the professional associations that support the electronics industry.

Sometime ago I mentioned that I intended to develop a dry cell battery charger as a project. I've since had several letters reminding me of this promise, including one from correspondent J.B. of Mt Martha in Victoria, who also included a copy of an article from the Melbourne *Age* (24/3/94) about the newly released Greencell Regenerator battery charger.

It's obvious from the opening lines of the *Age* article that this product is causing a degree of controversy: *A small player in the crowded portable battery market has attracted the anger of its competitors and the interest of the NSW Department of Consumer Affairs. Greencell Battery Company, a new division of the Dandenong based manufacturer Ringgrip, in turn a part of Gerard Industries, intends to distribute a battery charger it claims can recharge any battery.*

As you might have guessed, the charger is designed to recharge dry cells. The article goes on to say that the industry's lobby group, the Sydney-based Portable Battery Association is not entirely happy. Apparently Greencell is the only battery distributor in Australia that is not a member of this association.

The association is concerned about the safety aspects of the charger, while Greencell insists the product is completely safe. The company claims the fuss is because their competitors want to sell more batteries, and that the recharger is 'capable of recharging virtually any alkaline battery up to 10 times, as well as recharging heavy duty, super heavy duty and NiCad rechargeable batteries'.

I have since seen this product advertised (at $59 for the AAA and AA version, and $89 for the AAA, AA, C and D size batteries) and if it does all the manufacturer claims it can, it is an attractive proposition if you use a lot of dry cells. Gerard Industries also make the point that this product is environmentally friendly, presumably on the basis that there will be fewer batteries on the rubbish tip.

I guess the first question is: can dry cells really be recharged? The literature I have says yes, most definitely, and it seems arguments like those raised in the *Age* are not new. In fact, according to J.B., dry cells suitable for recharging are now being made.

As far as I know, the best way to recharge a dry cell is to pass an alternating current through the cell, with the positive half cycle passing more current than the negative half cycle. This can be done with two resistors, two diodes and a transformer. Passing a DC current through a dry cell, as with a normal rechargeable battery, doesn't work very well — if at all.

I don't know what charging principle the Greencell recharger uses, as I have no technical details of the product. And so far, I haven't had time to further develop my own dry cell charger. But it strikes me that anything able to reduce the amount of chemical rubbish, like old batteries, is a good thing.

So far as safety is concerned, I can think of many more hazardous things than recharging a dry cell. With suitable current limiting and a timer to stop the charge process, it's hard to imagine explosions, clouds of poisonous gases or whatever else might be claimed by those opposed to the idea. But when you realise that the portable battery market in Australia is worth around $300 million each year, it comes as no surprise that there's opposition to a product that might put a dent in this turnover.

So when will my version of a dry cell charger appear in *EA*? Soon, I hope. Now for some comments about NiCads...

Discharging NiCads

In the May edition, I included a letter from reader V.B., (Fivedock, NSW) who had been advised by battery manufacturer Arlec to discharge NiCad cells to zero volts.

I've now received a number of letters from readers with comments about this. Here's the first...

I'm an electronics engineer who has been supporting NiCad powered equipment for professional and recreational use for about 15 years, so I was quite interested to see the letter from V.B. in the May edition of EA, and to read your comments. I have designed a couple of cyclers over the years and worked with or repaired about 15 different models over this time, so I consider myself reasonably familiar with these devices.

I have NiCads that are well over 10 years old, which are still capable of delivering about 80% of their rated capacity if used soon after charging. Their main deficiency is higher than normal leakage over periods of about a week. Obviously I don't use these cells in critical applications, but they are handy to have around.

All units I'm familiar with have a discharge threshold between 1.0 and 1.1V per cell. All of the NiCad data I have located over the years specifies 1.1V per cell as a practical minimum working voltage. However, in a pack of say eight cells, there will often be a variation of at least 100mV between the terminal voltage of the cells after discharging the pack to 8.8V, indicating that some cells are not fully discharged.

However, discharging to an average voltage of 1.0V or even 1.05V per cell will generally ensure that each cell in a pack is fully discharged, without allowing any cell to be excessively discharged or have its polarity reversed.

If the pack is being cycled (i.e., discharged from a full charge to measure effective capacity and then recharged to maximum capacity), discharging to 1.0V per cell will generally give an indicated capacity about two to three percent greater than discharging to 1.1V per cell. A difference that's hardly worth worrying about.

Some people advocate discharging individual cells to 0V for medium to long term storage, and may recommend storing the cells with individual shorting links once the cell is totally discharged. This approach appears to work as well as cycling NiCad packs monthly (which I advocate), but is difficult to do with welded packs.

The basic problem is the differences in individual cell characteristics, which usually means any pack discharged to 0V will have some cells not completely discharged, and others forced into a polarity reversal.

I suggest it's inappropriate to discharge a pack of series connected NiCads to 0V, but that this approach is suitable for individual cells. (M.B., North Croydon Vic.)

Thanks for those comments, M.B. I agree that discharging a cell pack to zero volts will be likely to cause problems. And as the next writer points out, shorting a single cell to fully discharge it is an old and proven technique to restore a NiCad cell.

Short-circuiting NiCads

Your comments on NiCad cell discharging prompt me, as a past aircraft technician, to write about my experiences with these cells.

It was a requirement that the NiCad battery pack be removed from an aircraft every 100 hours of operation for 'deep cycling', or more technically, for 'capacity reconditioning'. This entailed discharging it at a known rate until the cell voltages (all measured individually) dropped to 1V. The time taken was then recorded to give the capacity of the cell.

A heavy shorting clip was then placed across the cell terminals and left for a few hours. The battery was then charged with a constant current source until the individual cell voltages reached 1.5V, after which the discharge process was repeated.

I found there was invariably a considerable improvement in cell capacity. Any cells not coming up to the required standard after about three charge/discharge cycles were replaced.

However, by experimenting, I found that the removed cells could be rejuvenated by keeping their shorting link in place for about three months. I assume this process completely removes the memory effect acquired by NiCads. Anyone who has discharged a NiCad will know how difficult it is to completely discharge them. Shallow discharging of a NiCad cell seems to have the most detrimental effect on its capacity. (W.J., Penguin Tas).

So there's a technique you might try.

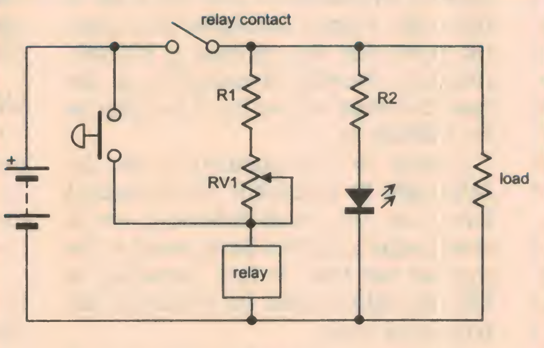


Fig.1

Discharge the cell to 1.1V, short it out for half a day (or more), then recharge it. It's reasonable to assume that the aircraft maintenance industry knows what's best for a NiCad, as a flat battery in a jumbo jet is a different proposition to batteries failing in a portable radio. Another reader says much the same thing, but adds:

I strongly recommend that NiCad cells or packs be deep cycled before using. That is, fully charged then fully discharged at least three or four times, to establish their full capacity. This should be done before the cells are used for the first time. I have also satisfied myself that deep cycling is necessary during use and does indeed restore the full capacity of the cell, provided the cell is healthy. (M.B., Tarraleah Tas).

Another reader quotes the General Electric publication titled the *Nickel-Cadmium Battery Application Engineering Handbook*. He has this to say...

Without going into great detail, GE recommend in some cases the discharge of a NiCad cell to zero volts with the application of a short circuit for 24 hours. However, they also suggest that cells and batteries used in non-regular discharge and charge patterns will not suffer the memory effect. GE also suggest that discharging a NiCad cell to 0.5V is satisfactory, although very little extra capacity is obtained by doing this.

It would therefore seem that Arlec are quite correct in the case of individual cells, and you are quite correct in the case of batteries. (H.C., Loftus NSW.)

So there's a number of letters, all saying deep cycle your NiCads if you want the best life expectancy. Individual cells can be discharged to 0V, but series connected cells should be discharged to around 1.1V per cell.

In his letter, M.B. says he has used the *EA* discharger to great advantage, but if you want an even simpler discharger, try this one...

NiCad Discharger

I wanted a way to discharge my 12V Camcorder battery, but it seemed a dumb idea to actually use power to do the job. Why not use some of the power being wasted?

Some readers may not be aware that the release current of a relay is quite predictable and is a lot less than its pull-in current. So, I fished out a 12V relay, pushbutton, a LED, some resistors and a variable resistor and put together a simple discharger circuit. (see Fig.1)

Momentarily pressing the button operates the relay. Current is then supplied through its contact to hold the relay on, via R1 and RV1. The LED lights and discharge current flows through the load resistor. When the battery voltage falls to a preset limit, as determined by the setting of RV1, the relay releases, disconnecting everything from the now discharged battery.

I found that I could quite easily set RV1 by using a variable power supply and a multimeter. Simply adjust RV1 until the relay drops out when the desired lower voltage limit is reached. In my case this was 11V. I've not included any component values, as these will depend on the relay and the battery voltage. My aim is to present the idea of using a relay to do the discharging job. (C.S., Lower Hutt NZ.)

Thanks for this simple circuit idea, C.S. Obviously a relay can only be used with battery packs with a voltage of 6V or more, but as this is quite common, your circuit could prove popular.

But then, if the aim of all the above is remove the so-called memory effect inherent in NiCad cells, what if there is no memory effect?

NiCad memory effect

It's generally accepted that NiCad cells can develop a memory, reducing the available capacity of the cells. The theory is that this happens if the cells are regularly partially discharged before being recharged.

Designers have responded by producing various discharging devices, special deep-cycle chargers (designed to discharge before recharging), battery analysers and so on.

However, it's worth noting that specialists in the industry have found that memory effect has no relevance for 99.9% of all applications, and say it has become somewhat of an exaggerated fable. If so, we can forget about memory effect, and instead worry about the real threats to our NiCads such as cycling without rest, overcharging and charging too quickly. (R.M., Narangba Qld.)

I've not seen any literature that supports this view R.M., other than the quotes made by H.C. (above) from a GE publication. It's my experience that deep cycling, as already described, restores a NiCad. Perhaps there's a reason other than removing the memory effect, but I don't know what it is. Still, perhaps you're right and we've all bogged down into believing something for the sake of conformity. Any opinions?

We've now looked at dry cells and NiCads, so here's a brief excursion into the realm of the lead-acid battery.

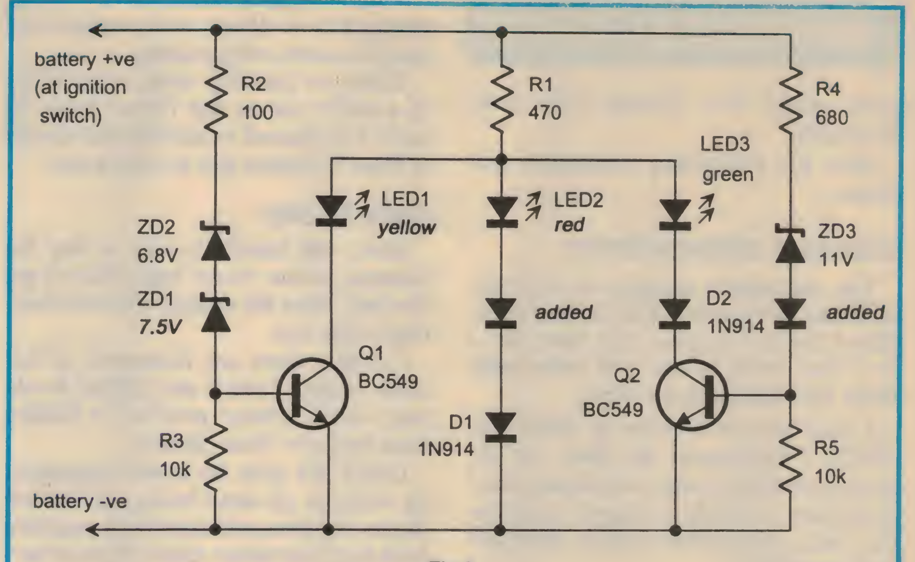


Fig.2

El Cheapo voltmeter

In March 1992, we described a simple voltmeter that uses three LEDs to monitor the condition of a 12V car battery. The original design of this circuit was developed by *ETI* some years before, and our article described modifications and a redesign of the circuit board so everything could be fitted inside a 35mm film canister.

The following letter describes a few more changes, and I've included the revised circuit in Fig.2. Text in black italics indicates a change from the original design.

I have made a few modifications to your El Cheapo Car Voltmeter, that give it a more representative performance. First, I found there was no significant difference in the voltage drop across the LEDs. I used 17mA for my test, and found the voltage drops were 1.97V for the yellow LED, 2.19V for the green and 2.21 for the red. Thus the selective turn-on effect was not available.

I overcame this by adding an additional signal diode in series with LED2.

Next, I felt that 11.6V was too low for a low voltage indication, so I added a diode in series with the 11V zener ZD3. This pushed the indication level up to 11.8V.

Finally, I substituted a 7.5V zener diode for one of the 6.8V zeners, to increase the overvoltage indication from 13.85 to 14.6V. This is more in line with current practice, where many car makers specify a voltage regulator setting of up to 14.5V under load, and as high as 15V under no load, at low temperatures.

I also made the red LED the low voltage indicator and the yellow the high indicator. I used rectangular LEDs glued together in a stack, and filed a neat rectangular hole in a removable panel on the dash. One thing I neglected to do was to put a piece of aluminium foil between the LEDs to prevent light spill between them.

My comments are not meant as a criticism of the project, which I think is very neat. However, there might be constructors worrying about overcharging their car battery, when their charging systems are within specifications. (A.M., North Turramurra NSW.)

Thank you for sending us these modifications A.M. This simple but effective project is very popular, and it's possible LEDs being made today have different characteristics to those avail-

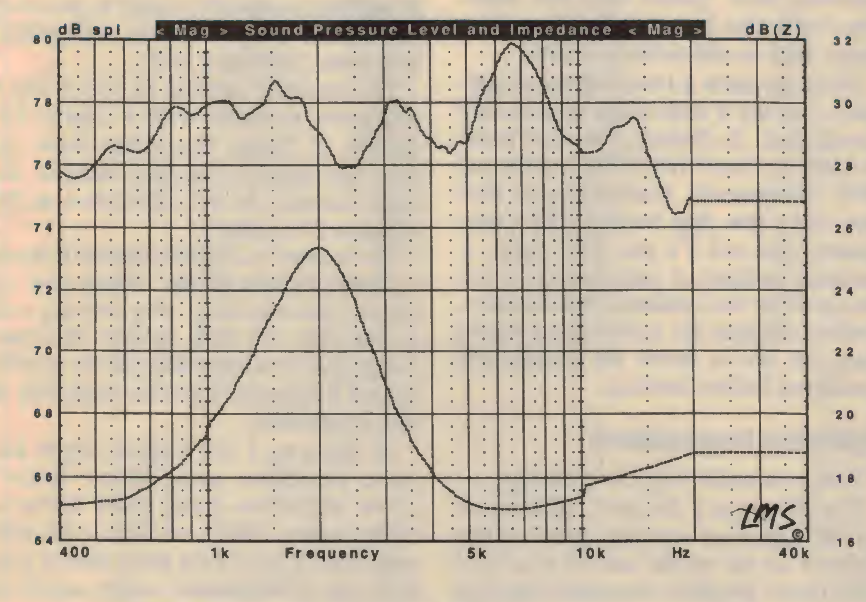


Fig.3

able when the circuit was first developed.

Now for something completely different...

Industry associations

The electronics industry is not overwhelmed by representative bodies established for the purpose, but there are a few. The writer of the next letter seeks some information about these.

I have noticed mention of TESA and TETIA. I understand that these are associations of electronic technicians, but I don't know what the acronyms stand for. Do these associations accept hobbyists and engineers?

I have a background in radar and marine electronic systems, but when I leave the defence forces, I would like to become involved in TV and computer servicing. My qualifications are Radio Fitter/Mechanic — Electronic Systems and a Certificate of Electronics (both NSW). Could you recommend any associations that might be suitable for me to join. (P.B., Perth WA.)

TESA stands for Television and Electronics Services Association and TETIA is the acronym for Television and Electronics Technicians Institution of Australia. These two bodies are related, and sometimes even produce joint publications.

Another group is ESIA (Electronic Services Industry Association), which (I think) performs a similar role to TESA.

These organisations are for electronics service technicians, with an emphasis on VCR and TV servicing. From memory, ESIA and TESA support the business side of things, while TETIA concentrates on technical matters. However, I'm generalising and there's no doubt much more to these organisations. I think they are all represented in most states of Australia.

These associations are not for hobbyists, and in fact are sometimes rather hostile towards the do-it-yourself TV repairer, in the belief that a 'back-yarder' is taking away business and giving the industry a bad name. However, if you are earning your living as a serviceman, it's a very good idea to join one (or more) of these organisations.

There are also a number of institutes for engineers. The IREE (Institution of Radio and Electronics Engineers) is a well known one, another is the Institute of Electrical and Electronics Engineers (IEEE). Membership is usually restricted to those with university qualifications, or equivalent.

There are probably more associations of a similar nature that I don't know of, and I'd be pleased to include brief details of these if readers like to advise me.

Data books

Have you found it's easy to buy the component, but almost impossible to get the data about the device? Our next correspondent has.

I realise there are thousands of LSI chips, many of which are difficult to obtain. But a greater problem is finding data books for these devices.

Could you give me some suggestions on where to get data books, and how to obtain the semiconductors not available from local electronic stores. How do servicemen get specific parts for electronic appliances in a few days? These parts are never available at the popular electronic parts suppliers. (D.P., Riverview Qld.)

Data books have always been a problem to find. One source to try for data on National Semiconductor devices is Protege Solutions, 24 Greenview Parade, Berowra 2081, phone (02) 456 4546. You could also try contacting manufacturers, such as Motorola or Philips.

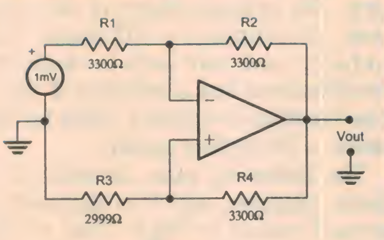


Fig.4

There are quite a few component suppliers that sell a wide range of parts and components. In Sydney, two that come to mind are Geoff Wood Electronics and WES Components. You might even find they sell a few data books. WES Components also sell TV and VCR parts. A common method of getting parts is via the agent for the appliance manufacturer. Finding out who the agent is may not be easy, and this is where the associations mentioned before can help.

Speaker impedance

Here's an audio topic for a change...

Out of interest, I did some calculations on the effect of varying speaker impedance on the output current of a 50W RMS power amplifier. An eight ohm load dissipating 50W takes a current of 2.5A and the output voltage is 20V RMS. If the load impedance increases to 16 ohms, the current required to produce 50W falls to 1.768A, and the RMS voltage rises to 28.288V. A four ohm load needs 3.535A and a voltage of 14.14V.

The Challis report in February on the Betetec Aaron speakers measured impedance swings of this magnitude. As the magnetic field gap of a loudspeaker is constant, then these impedance swings suggest various sound pressures for the changing currents.

Would it be possible to measure the output current and feed this information back in some way to the amplifier to compensate? Perhaps valve amplifiers sound 'better' because they have very little negative feedback and can compensate for varying speaker impedance. (G.B., Bomaderry NSW.)

The aim of any speaker manufacturer is a flat output response from their system. That is, if a constant level input signal is applied to the power amplifier, the sound output level (SPL) as measured with a sound level meter should also be constant. While your argument that varying speaker impedance will produce a varying SPL seems logical, this is not what happens.

You can see this in the graph of Fig.3, where the bottom curve shows the speaker impedance and the top curve the SPL over the frequency range of 400Hz to 20kHz as measured by a calibrated measurement system.

The impedance scale is on the right, and shows the impedance varying from 17 ohms to over 25 ohms. The SPL in dBs is the scale on the left, which shows the speaker output staying within a 4dB band. A 3dB change is regarded as barely audible, so a 4dB change is probably discernible only to those audiophiles who have 'calibrated ears'.

The speaker system in Fig.3 has a crossover network with a centre frequency of 2kHz. But notice how the SPL has hardly changed, despite the large increase in the impedance at the crossover frequency.

The reason is complex, but boils down to many factors in the design and inherent characteristics of a moving coil loudspeaker. As well, speaker enclosure design plays an important part in speaker system frequency response, especially at low frequencies.

By the way, I don't totally agree that valve amplifiers sound better. Today's power amplifiers sound pretty fantastic, unlike many 1960's or 70's solid state amplifiers. I have long since retired (and sold) my 25W/channel valve amplifier, and have never regretted it.

Now for a couple of reader requests.

1Hz generator

I want a circuit that will produce a reliable 1Hz pulse using the 50Hz mains as a reference. I want to use this pulse to run a clock, and I would prefer to use the mains rather than a crystal as the reference. (L.T., Shelley WA).

I've searched our database, and I cannot find any project that does this. I've also scanned a number of data books in the hope there's a dedicated IC that has a divide by 50 function. But no luck.

I can think of various circuit ideas, such as a digital counter IC like the 74LS290 connected first as a divide by 10 (decade counter) then another connected as a divide by five. Or you could use the two halves of a 74HC390, in the same way. Another idea is a 50-stage shift register, pulsing a circulating high through each stage. There are CMOS shift register ICs that could be used.

However, these are only ideas, and I'm sure there's a simple answer. If anyone can help, please write and send me your circuit idea.

ATM28 DVM circuit

And perhaps someone can help our next correspondent, who seeks a circuit diagram:

I am trying to locate the circuit diagram for the ATM28 digital voltmeter. It was designed as an educational kit by Australian Test and Measurement, a company that is now out of business.

I need this circuit as I have recently bought the ATM27 (Eight-Channel Temperature Meter), but I can't use it as a stand alone system as it derives the -5V rail, calibration and display functions from the ATM28. I have tried every supplier who used to handle these kits, but they have none left. (Wayne Egan, RSD C320 Ross Creek, 3351.)

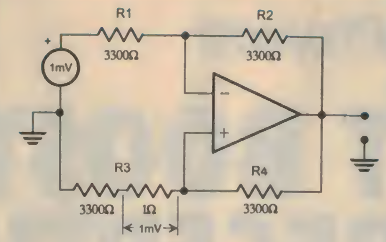


Fig.5

What??

Now that you've got the solution to the July What?? question, you should be able to quickly work out the answer for this month's question, which again comes from Bryan Maher. As before, find the output voltage of the circuit shown in Fig.4. Assume the op-amp is ideal. That is, it has infinite gain and input impedance.

Answer to July's What??

The output voltage is 6.601 volts. Fig.5 shows R3 divided into a 3300 ohm and one ohm resistor. This makes the circuit easier to understand as you can now see that as all the resistors have the same value (except the one ohm resistor), the circuit is symmetrical. Because the op- amp is ideal, the differential voltage at its inputs must be zero, and therefore the voltage drops across R2 and R4 are equal.

Similarly, the voltage drops across R1 and the 3300 ohm component of R3 are equal, and equal to those across R2 and R4. The 1mV voltage source in the upper half of the circuit must therefore be balanced by a 1mV voltage drop across the one ohm component of R3.

By Ohm's law, the current in the one ohm resistor is 1mV/1 ohm, which is 1mA. The drop across R4 is 3.3k x 1mA = 3.3V. The voltage drops across the remaining resistors are therefore also 3.3V. By Kirchhoff's voltage law, the output voltage is 3.3 + 3.3 + 0.001 = 6.601V. ❖

NOTES AND ERRATA

Simple Capacitance Meter (Circuit and Design Ideas, June 1994): The author has advised the description should read R5 instead of R6 in the last paragraph. The value for R5 should read 100k, not 10k in the example given in this paragraph.

Digital panel meter (June 1994): In the circuit diagram, capacitor C9 is shown upside down. The component overlay on p.60 is correct. Our thanks to Mr Daniel Ford for drawing our attention to this error.

DSO Adaptor (May-July 1994): David Jones, designer of the original DSO Adaptor, has now added to his software the ability to print out to IBM and HP LaserJet/InkJet compatible printers, as well as Epson compatibles.

When HP printers are selected, the software offers a choice of resolution/size options, and also optional 'compressed aspect ratio' printing.

The new DSOA Software Version 3.2 is now also compatible with the original DSOA. It is available from Tronnort Technology, 12 Copeland Road, Lethbridge Park 2770. The price is $30 plus $5 postage within Australia; registered users can upgrade for $15.

[redacted]

[redacted]

Mini Construction Project:

LOW COST BOOSTER FOR AM RECEPTION

Here's a very low cost, surprisingly simple way to boost your reception of AM (and low frequency) signals. It uses no active components at all — acting rather like a 'magnifying glass' for weak signals. If you'd like to tune into distant stations, it's well worth a try...

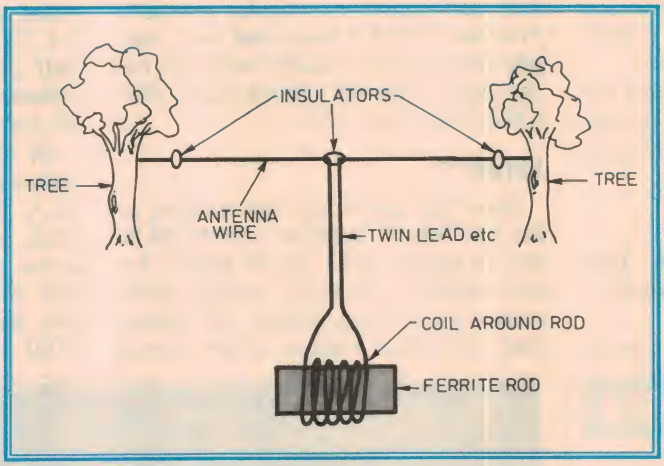
by TOM MOFFAT, VK7TM

Do you still listen to AM radio? Many people do, despite so much broadcasting emphasis being moved to the FM band. Country people can only receive the city FM stations over a relatively short distance, but AM stations still reach far and wide.

As for city listeners, FM seems to offer mostly automated pop-music stations with little personality or soul. And in a small city, such as Hobart, here's a sampling of the local AM scene on a given day:

ABC Metropolitan Radio — cricket.
ABC Radio National — a talk about lesbian artists.
A station broadcasting parliament.
A station broadcasting continuous horse-racing.
Newspaper readings for the blind.

So there is an incentive to reach further afield for AM signals from other cities and from country stations.



As you can, Tom's booster is very simple, an outdoor antenna connected to a ferrite rod which couples magnetically into the antenna rod of your radio.

Country AM stations in particular are still run by people, instead of computers, and they give you a taste of what life is like in other places.

At the time the above programs were being broadcast in Hobart, there were some more stations available on my own radio, courtesy of the 'magic' gadget to be described herein:

7SD Scottsdale Tas, 540kHz (noise-free local quality)
3AR Melbourne, 621kHz (weak but listenable)
7NT Launceston 711kHz (medium strength)
3LO Melbourne 774kHz (weak and fast fading)
3GI Sale, Vic. 828kHz (noise-free local quality)

The two Melbourne ABC stations were running the same programs as their counterparts in Hobart, as was the one

Left: The smaller coupler positioned for use with a Sony ICF-SW7600 receiver. This gave good reception of Melbourne station 3LO, from Tom's location in Hobart. Right: The larger coupler shown with the Sharp Ghetto Blaster. The correct position for the coupler with this radio is directly back from where it's shown, beneath the radio itself.

in Launceston. But the Scottsdale station was presided over by a friendly woman announcer, who played records interspersed with community announcements and commercials about businesses in her little town. Listening to her was like going on holiday to another part of the state!

The Sale station had a fellow talking about why tourists should visit Gippsland instead of the Gold Coast. I think he had a hard selling job, but he was giving it a pretty good thrash...

Note that the Scottsdale signal was coming from northern Tasmania, almost 250km from Hobart, and the one in Gippsland, perhaps twice that far. This was happening in the middle of the day, with no help from sky-wave reflections. Yet both signals were full strength and noise-free, with no fading. Just like local stations.

There is probably one station that stands out above all others as a target for long-distance listening, and that is 2TM in Tamworth on 1287kHz. I have received several letters from people in places such as Albury who dearly want to listen to 2TM. And that's one reason I developed this project — to soup up the signal from 2TM. The attraction is country music, and just about any night of the week you can get a much-needed fix of Smoky Dawson or Slim Dusty.

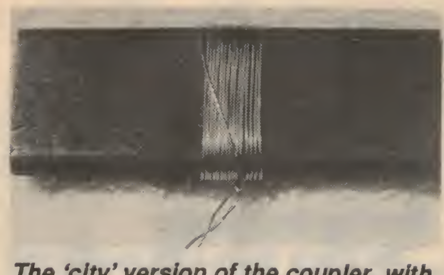
So now we present a 'station-getter' project that's going to cost you all of seven bucks to build. It will make a pretty ordinary AM radio perform like an expensive communications receiver. This is not an exaggeration — the effect of this little gadget is quite miraculous.

What it does

As you probably know, the antenna in most modern AM radios is a ferrite rod with a coil wound around it. The coil is actually part of the radio's input tuned circuit. A variable capacitor is connected across the coil, and you adjust this capacitor with a knob as part of selecting the desired station.

Since the ferrite rod is straight (not formed into a circle as in a toroid), it can react to RF energy coming from a distant transmitter, developing a voltage across the coil which is amplified and detected within the radio.

This is a pretty good system, which allows a radio to be carried around in a pocket while receiving low frequency signals which would otherwise require a very large antenna. Because of its simplicity, a ferrite antenna is usually also used on mains-powered stereo receivers and ghetto-blasters, even though portable operation is not required.



The 'city' version of the coupler, with about 15 turns wound on a ferrite rod salvaged from a defunct pocket transistor radio.

Most AM radios work fairly well within a city, receiving local stations, and that's satisfactory for most people. But with so much broadcasting activity on FM nowadays, manufacturers tend to treat the AM section of a stereo or ghetto-blaster as a poor relation. It's made to work, but only just.

Since only short-range reception is required, the AM receiver is usually designed to be quite 'deaf'. Interstate stations might be heard at night time, but during the day it's locals only. Low sensitivity eliminates the problem of strong signals overloading the receiver, and its dynamic range is usually abysmal. (For a detailed discussion of receiver overload and dynamic range, see my articles 'Using Receivers', soon to appear in *EA*.)

What our project will do, then, is deliver a 'magnified' version of the AM broadcast band to the receiver; tiny interstate signals become big local signals. The local signals themselves are magnified too, and some of them might become quite gigantic. So we have to do some careful thinking about receiver overload.

Our scheme begins with an outside antenna. You probably already have a suitable antenna, but if not, it's not hard to organize. The best antenna, particularly in an urban environment, is a balanced dipole as explained in the article 'A Variable-Tapped Balun for HF Receivers' (*EA*, May 1991). But instead of a balun, here we will connect the antenna's balanced output to a 'ferrite coupler' which in turn will retransmit incoming signals into the AM radio's own ferrite antenna.

I like to think of this idea as a magnifying lens for radio signals. It's like using a telescope to concentrate very weak light rays from the stars into something strong enough for the eye to see. We haven't increased the eye's sensitivity, we've only collected the incoming light with a large lens and concentrated it onto an area the size of the eye's cornea.

In the case of the dipole antenna, it is like a large telescope lens which collects weak signals over a wide 'aperture' and concentrates them into a little piece of ferrite rod. The coil wound around it induces electromagnetic radio 'signals' into the rod, which then acts as a mini-transmitting antenna, sending the magnified signals over a short distance into the radio's own antenna rod. This is an entirely passive process; there are no amplifiers, only the power of the radio signals themselves.

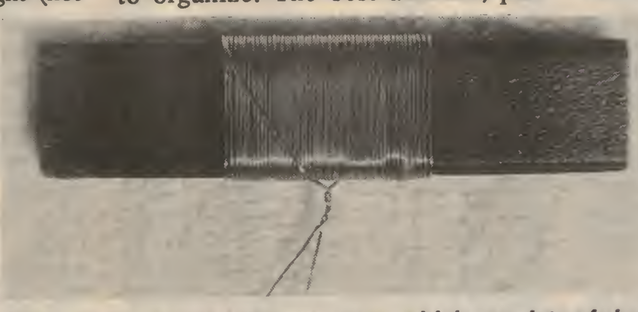
Making the coupler

The ferrite coupler is simply a coil of wire, wound around a chunk of ferrite rod. The rod can be obtained in several ways. An easy method is to rat one from a defunct transistor radio. The smaller, flat rod in the photos was obtained in this way. Remove whatever coil is on the rod (it will probably just slide off), and replace it with your own.

Most electronics retailers and mail-order houses have ferrite rods at prices ranging up to eight dollars or so. Most of these are quite large, but you can easily snap one in half and give the other half to a friend.

The easiest option comes from Dick Smith Electronics, catalog number R-5100. This is a flattish rod with a pre-wound coil on it, costing $1.75. The coil slides off, leaving a nice compact ferrite rod. The larger coupler in the photos began life as one of these.

As for wire for the coil, I used 28 gauge B&S, mostly because I had a roll of it. The wire must be enamel insulated, preferably of the type that automatically burns off from the heat of a soldering iron (to save having to bare



The 'country' model of the coupler, which consists of about 50 turns wound onto an R-5100 ferrite antenna rod from Dick Smith Electronics (discard the original coil).

the ends). The catalogs list 26 or 30 B&S; either should be fine. A 25 gram roll will give you plenty of wire to try various numbers of turns; the cost will be around $5.25. Total coupler cost: $7.00.

How many turns? Well, that depends on many factors. In general, the more turns you wind onto your coupler, the more radio energy will be fed into it from the antenna. Too few turns and the coupler doesn't magnify the signals enough. Too many turns and the radio tends to overload on strong local stations. Overload is almost always indicated when you hear two local stations mixed together on a frequency not assigned to either of them.

If you live in the country, where there are no local stations within say 50km or so, many turns may be appropriate. The larger coupler in the photos is the 'country' model, having about 50 turns or so. This gives best magnification of distant stations, and since there are no local stations, overload is no problem.

If you live in the city however, you may find you can use no more than 15 turns or so. Otherwise your radio will experience heavy overload from local stations. The smaller coupler in the photos is the city model, used with a Sony ICF-SW7600 radio to receive the distant stations mentioned above. The Sony radio is pretty good on its own, but with the coupler, particularly in the country — WOW!

The number of turns also depends upon how close you can place the coupler to the radio's own internal antenna rod, as well as the sensitivity of the radio.

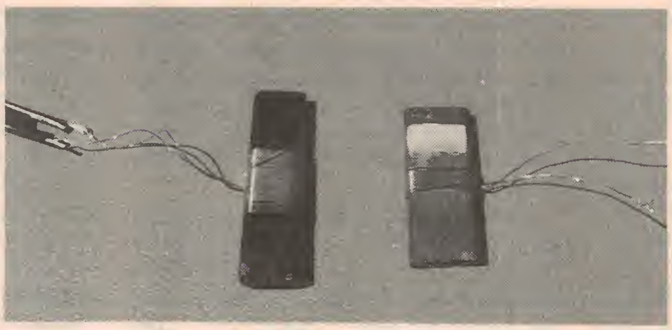
It turned out that the Sharp ghetto-blaster, used in the city of Hobart, required the larger country-model coupler to perform properly. This is because its internal antenna seems to be mounted a fair distance from the outside of the case, so there was a lot of distance between the coupler and the antenna. The ghetto-blaster is also quite deaf, but when fed with the country-model coupler it produced excellent results with very good audio quality from both the Scottsdale and Sale stations.

Once you've decide on the number of turns, wind them onto your ferrite rod nice and neat, keeping the coil more or less centred along its length. When you're finished, twist the wires together, remove the insulation from the ends, and you're done. The photos show the way.

Placing the coupler

The idea is to place the coupler near the radio's internal antenna — but unless you open up the radio and have a look, you won't know where the antenna is mounted.

To find the antenna, tune the radio to a weak station. Then, with the coupler connected to the outdoor antenna, probe around the outside of the radio with it. You will find the station suddenly jumps in strength as you come near the radio's internal antenna. If you move too close you may experience overload; in this case back off a bit, or use fewer turns.



The 50-turn coupler is shown at left connected to the end of a 300 ohm downlead. The 15-turn coupler is shown alongside for comparison.

The photo of the Sony radio shows the coupler in its optimum position. This allows the coupler to be moved slightly closer for weak stations, or if overload occurs, the coupler can be moved slightly back. It serves as kind of an RF-gain control.

In the case of the Sharp ghetto-blaster, the coupler won't work where it is shown in the photo. It must be shoved directly back from that position until it is underneath the radio, midway between the front and back. This appears to be the closest position to the internal antenna.

The country coupler shown with the Sharp radio normally lives at our beach shack at Cygnet, about 60km from Hobart and away from the influence of local stations. Here the coupler is used with a fairly old Sony ghetto-blaster, and in this case it must sit on TOP to be near the radio's antenna. With this arrangement the Sony can haul in AM stations from all over Tasmania and most of Victoria; 3AW Melbourne comes in great in the daytime.

An outside antenna

Fig.1 shows a plan for an external antenna, connected to a coupler. The length of the antenna is not really important, but in general, the bigger the better. The most important thing is that the antenna be absolutely symmetrical, to maintain electrical balance and thus reject nearby interference from power lines, etc.

Just about any old wire will do for the antenna, providing it's strong enough to stand up under its own weight. The classic way to support the antenna is strung between a couple of trees.

The feedline between the antenna and the coupler should consist of two parallel wires. Forget coaxial cable, it isn't BALANCED. The feedline can be of figure-8 lamp cord or speaker wire. My favorite is 300 ohm television antenna twin-lead; its very light, and very cheap. For proper balance the feedline must be connected exactly in the centre of the antenna. Any imbalance will mean more noise in your receiver.

If you use twin-lead you will find it can be run through an open window and then the window can be closed, clamping the flat wire. Inside, leave enough lead-in to reach the radio and then connect the two wires of your coupler to the antenna wire.

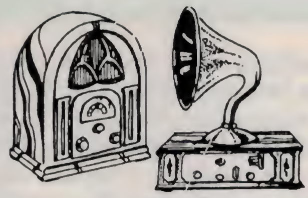
Of course this antenna will also work nicely with a shortwave receiver. In this case you can use a balun instead of the coupler, and then feed the receiver with coax. See the earlier variable balun article for details.

This antenna coupler, then, will make your AM broadcast listening much more interesting. You may even get inspired to try a little broadcast band DX-ing. At night I can hear New Zealand stations just like the locals, and I've even received signals from as far as away as Malaysia.

If your radio receives long-wave, try the coupler here as well. At night you will probably hear aviation beacons coming in from all over Australia. They are identified in slow Morse Code, and some of them carry recorded airport weather information. The one at Sydney's Kingford-Smith airport seems to announce the weather with a speech synthesiser; it's certainly worth a listen. ❖

Vintage Radio

by PETER LANKSHEAR



The Vintage Serviceman...

Always a very popular feature of *Electronics Australia* and its precursors, the monthly Serviceman column has been published for more years than I care to remember. Today it concentrates mainly on TV and VCR topics, but in pre-television times there was just as keen an interest in radio servicing experiences. Recently, I was taken back in time with a series of diverse repair jobs that could well have been the subjects of a 'Serviceman Tells' column of a generation ago, and which I am sure will be of interest to vintage radio enthusiasts.

We had decided to take a holiday, in an overdue visit to my old home town, two or three days' travel away. Soon after we had given warning of our plans, we were informed that lined up were several favourite old radios, in need of some 'tender loving care' — so would I please come prepared. There are still plenty of valve radios in active service...

It looked as if I would not be short of something to do; but with a minimum of facilities and equipment, I was a bit dubious as to the chances of success. For one thing, replacement components could well be a problem. These days it is not always a matter of visiting the nearest electronics store for valve radio spares!

However, I packed up some tools, a digital multimeter, a range of capacitors and resistors and a selection of valve types that were, as best as I could recall, likely to be encountered. To aid my vintage eyesight as well, a jeweller's loupe was included!

Atwater Kent 246

First to be dealt with was a really classic receiver, my daughter's 1933 Atwater Kent model 246. The complaint was that it would go sometimes, but at other times it was completely dead.

Fortunately, I had come during one of its dormant spells, and a close look at the rear of the cabinet soon revealed the trouble. The filament of the 47 output pentode was not glowing, but gentle pressure on one side of the valve immediately brought it to life.

There were three likely causes of the problem. The socket could be faulty, there could be faulty soldering to a filament contact on the socket, or there could be a dry joint in a base pin of the 47. From previous experience and because it was easiest, I decided to try the valve first.

After the solder was melted out of the filament pins, a close inspection with my magnifying glass showed that the tip of one of the wires had never been tinned. In fact, it was black — a classic fault. Fortunately, it was possible to reach sufficient of the wire to scrape it clean enough to resolder. Had this not been successful, the base would have had to be completely removed and the leads all extended with fuse wire, and then the base glued back on before resoldering.

Fig.1: With only three Philips Noval valves plus rectifier, this little New Zealand made Philco receiver has a very basic circuit not unlike the 'Little General'. After 40 years of trouble-free service it developed a classic fault...

Internal fireworks

The second patient was a Columbus 90, a popular Radio Corporation of New Zealand model of the 1940's. With bandspread shortwave tuning, a negative feedback switched tone control, and generally a first class performer, it was RCNZ's 'top of the line' receiver for several years. The description of the symptoms was a bit vague, but within a few seconds of the receiver's being switched on, a loud rasping roar came from the 10" loudspeaker.

A quick look at the rear of the cabinet and the culprit was obvious. The 5Y3GT rectifier was filled with fireworks, and a bright lilac and blue glow. As someone once said, some of the vacuum in the valve must have leaked out! Fortunately, I had packed a replacement 5Y3GT, and within moments, the model 90 was performing with its intended vigour.

Familiar problem

Two down, and I had not even needed to take a chassis out of a cabinet!

The next call involved a complaint that

a medium sized Bakelite cased radio from Dominion Radio was locked on to one station and could not be shifted. This is a common enough problem and is usually the result of a broken dial cord, which can sometimes be a patience-testing exercise and usually entails installing a new cord.

A remarkable variety of 'do-it-yourself' efforts can be encountered in cord replacement, with string and monofilament fishing line being popular, and often with the wrong threading sequence. In fact, *real* dial cord is woven, rather than twisted or solid, and has become hard to find. However, modern *braided* fishing line of suitable diameter (available from large sports stores) is an effective replacement.

In this case, the word 'locked' meant just that. Nothing moved in the tuning department, and rather than spinning freely, the knob was very hard to turn. This time the chassis *had* to come out...

Once the chassis was out of the cabinet, the problem was apparent. The cord which towed the pointer along a metal rod was intact, but clearances were fairly tight and the original grease lubricating the rod and pulley wheels had mixed with the dust that inevitably gathers inside radios and had dried into a hard deposit — effectively blocking the pointer's travel. So the buildup was cleaned off, some sewing machine oil was run along the rod and on to the pulley spindles, restoring normal operation.

Too easy, so far!

The first three problems had been simple and straightforward, with owners suitably impressed by the rapid repairs; but Nemesis was about to strike...

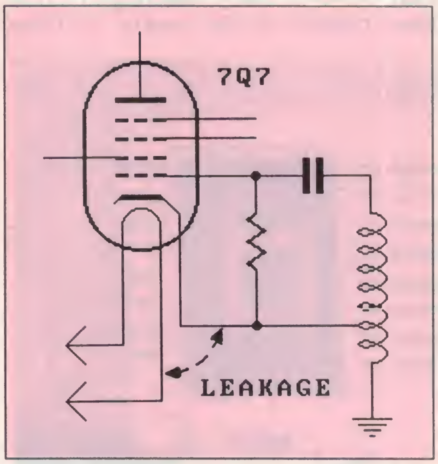
The next job, a large mantel Courier made by Radio (1936) Ltd, one of New Zealand's major manufacturers, proved to have a puzzling fault. A multiband model dating from the early 1950's, it has a mixture of eight-pin octal and loctal based valves.

The complaint was that sometimes when the receiver was first switched on it made a lot of noise, much as if it were tuned off a station. Sometimes this noise would persist, but often it would disappear after a short time. Needless to say, when *I* switched on the set, it behaved perfectly. There was nothing for it but to take it back to my son-in-law's workshop and set it up for some serious work.

Eventually, I managed to catch the elusive fault for about 10 seconds. The effect was a noisy background between stations, but the strange thing was that when a carrier was tuned in, there was a 50Hz modulation hum, sufficient to drown out the programme. As the volume control action was normal, the fault had to be in the RF/Mixer/IF sections.

Fig.2: The Bell 'Colt', which provided some headaches out of all proportion to its modern size and circuit. Colts surely hold the World's record for longevity as a production model. First produced in 1951, it was made during the following 20 years, and continued as a transistorised set until 1980! Australian readers may recognise the cabinet as having been used for the Airzone 458 of 1946.

I had completely overhauled this receiver a few years ago, so I felt that the fault was unlikely to be a capacitor. By reason of its only occurring during warmup, and the hum being 50Hz, it seemed very likely that the fault was heater-cathode leakage in a valve. In this receiver, RF bias is supplied by the AGC line and the cathodes of the valves are earthed. Usually, in such cases, heater-cathode leakage is often not significant — certainly not the overwhelming roar that this was creating.



This simplified diagram of the oscillator section of the Courier receiver illustrates how heater to cathode leakage could create severe hum by modulating the RF oscillations via the coil tap. Had the cathode been directly earthed the leakage could well have gone unnoticed.

This receiver has a heptode 7Q7 converter valve, an uncommon type that is in fact electrically identical to the more familiar 6SA7 and similar to the miniature 6BE6. As these valves have no oscillator anode, the cathode would not necessarily be directly earthed, but connected to a tap on the oscillator coil. It seemed likely that this was the way the leakage hum could be modulating the oscillator signal.

There was not much more I could do but to identify the 7Q7, so that it could be swapped for a good one that I would send when I returned home. I do not like having to leave 'cures' for intermittent faults unproven. Too often the brilliant 'diagnosis' turns out to be wrong, but it seems from subsequent reports that in this case we were lucky.

Final surprise

The final holiday 'surprise' was the small plastic-cased and New Zealand made Philco receiver shown in Fig.1. This had given 40 years of faithful service and I was assured that previously, it had never been serviced. The complaint was that it was 'very weak'.

I had not been warned of this job and had not brought with me any of the 'Rimlock' valves that it used. Australian readers will be unfamiliar with this series, which Philips introduced in 1950/51. They are similar to the standard Noval series, but with eight pins and a dimple on the side of the base which locks into the skirt of the socket.

This particular receiver is of the 'Little General' type, but with automatic gain control. The simple circuit, with the diode detector feeding the output pentode directly without the benefit of an audio amplifier stage, would have contributed to its long and trouble free life. But now reception was practically nil. Voltages appeared correct, and the EL41 audio stage was lively enough.

As far as I could tell, the EAF42 combined diode/pentode IF stage and detector was OK and a check with the test meter on the grid pin of the oscillator confirmed that *that* section of the ECH42 mixer was working. This left the hexode section of the mixer.

With visions of having to post up a further replacement valve, I was idly probing around with a screwdriver and touched the control grid pin of the mixer socket — creating a loud burst of noise. Clearly, the valve was not dead after all...

This pin is connected to the aerial tuning coil with about 30mm of plastic covered wire, and for no particular reason I

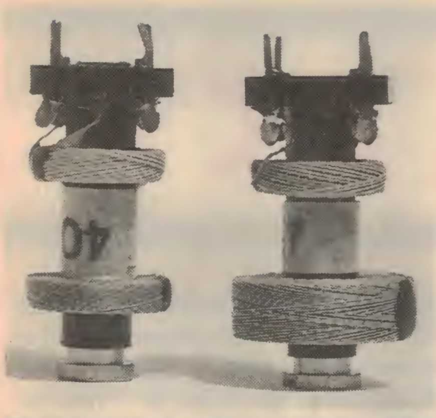


Fig.3: Matched aerial and RF amplifier coils. The upper tuned windings are of course identical, but the relative difference in size between the two lower untuned windings is clearly visible. The aerial coil is on the left. Swapping the two can seriously affect the performance of a receiver.

touched the coil end of this lead. There was no response! Taking care not to disturb anything, a check with test meter confirmed that there was no continuity between the coil and grid whatsoever!

Was the wire broken inside its insulation? A good tug on the lead showed the answer. It came away cleanly from the coil, without a trace of solder! A classic dry joint, it had taken all this time to reveal itself.

In this case I was fortunate in that the symptoms were sufficiently permanent for me to track the cause down. Similar faults — when intermittent — have ruined many a serviceman's reputation!

A welcome home

Of the five sets I had repaired, three had faulty valves, one had mechanical trouble and one had bad soldering. That there were no faulty capacitors or resistors involved can be ascribed to four of the receivers having had complete overhauls in recent years.

But the world does not stop for holidays, and when I finally arrived home, waiting for me was a Bell 'Colt', a little box of tricks that was to take far longer to fix than it should have and bring me back to earth with a jolt. A laconic note taped to the cabinet simply said 'NO GO'.

The Bell Colt probably holds the record for being the radio with the longest production period of all time, and there are plenty of them around. The circuit is simple and the components of good quality. Normally there is nothing easier to repair than a Colt. "No problem", I thought, "I'll fix this one in short order".

Common faults are an open-circuited speaker transformer, or resistors which have changed value. Sure enough, the 150k anode load resistor for the audio stage measured more than two megohms. This was soon replaced and while I was about it, I tested the valves which all checked out as being quite healthy. With the power turned back on I confidently sat back, waiting for a response.

The audio amplifier was certainly working now, but there was still no reception. So much for my quick repair job! The problem appeared to be in the mixer or IF stage, but the voltages were correct. There were no open circuited windings and the oscillator was working.

It was then I noticed something that I had previously missed. The wax that seals the IF transformer tuning slugs had been disturbed. Each of the four cores had been attacked and damaged, apparently with a steel screwdriver. The correct tool for these particular cores is a hexagonal plastic alignment tool.

Two of the slugs were still serviceable when reversed, but I had to replace one transformer whose former had been cracked. It is not uncommon to find that screwdriver adjusted trimmers have been screwed up tight, but to remove wax seals to get at ferrite slugs requires quite a lot of determination...

As long as there have been radios, there have been people who attack preset adjustments in an attempt to 'fix' faults. They are closely related to car owners who 'tune up' an ailing vehicle without any real knowledge of what they are doing. At best they incur for themselves extra labour costs; sometimes, as in the present case, real damage is done.

With the transformers repaired and replaced, IF realignment was straightforward, and there was some reception; but the stations were in the wrong places. By now I was prepared for anything, and sure enough, I found that the oscillator coil slug had been tweaked. Fortunately, the padder in these sets is fixed, eliminating one variable. Even so, it took quite a while to get the oscillator tracking correctly, especially as the tuning capacitor trimmers had also been 'adjusted'!

It seemed that mercifully, due to access to its slug being obscured by wiring, the aerial coil had escaped attention. However, although by now the set was operating well enough at the top half of the broadcast band, the sensitivity below about 1MHz was below normal. I rechecked the alignment, but the tracking was correct. Was there *still* something amiss?

By now I was getting frustrated with the 'simple' job, and while I sat glowering at the chassis, and the aerial coil in particular, I realised that the primary winding didn't look quite right — it seemed to be too big.

Different primaries

To simplify tracking with random external aerials, and to equalise gain over the tuning range, it has been common practice to fit both aerial and RF amplifier broadcast band coils with primary windings which are resonant at a frequency a little below 500kHz. However, as aerials provide additional capacitance, aerial coil primaries have a lower inductance than their companion RF coils. The difference can be clearly seen in Fig.4. Could it be that this receiver had the wrong type of coil? Surely not — but with this particular set, anything was becoming possible.

That was the problem. A replacement aerial coil restored performance to normal. It would seem that somehow, somewhere, possibly in the factory, the wrong type of coil had been installed. Who knows, maybe the damage to the receiver was the result of attempts to remedy the poor performance. I never did find out.

Simple sets can sometimes have obscure faults!

A mystery set

Finally, this month, I have a request for information. Readers will recall that in the October 1991 Vintage Radio column, we described the Philips 'Tin Trunk' type 2510 receiver. Recently an equivalent battery version has come to light. Called a 1411, it appears to be original, but is a mystery as none of the available catalogs refer to it.

If any reader has one or knows of one, I would be grateful to hear from them care of *EA*. ❖

MARKETPLACE

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50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Below we feature some items from past issues.

August 1944

Lights for night vision: A remarkable instrument for calculating men's ability to see at night is being used by the Canadian Navy to increase the fighting efficiency of their ships.

Look-outs with the keenest sight are being selected for dark watches and a way has been found to permit the captain or navigator to consult the chart with the right light without being temporarily 'blind' when returning to the bridge.

Erasing fluid: Army censors have substituted for the 'blue pencil' a new erasing fluid, which removes all trace of handwriting, wherever it is applied.

Reasons for the introduction of the new fluid were: Censors found it difficult under frontline conditions to obliterate words completely with pen and ink or blue pencil ; and relatives' complaints that the use of scissors eliminated words on the back of the letter.

August 1969

1MV electron microscope: An electron microscope which will work at one million volts (ten times the common voltage in use) has been developed by the National Physical Laboratory in the UK. The voltage of an electron microscope governs the thickness of specimens which can be examined. By increasing the voltage to 1MV, the scientists expect to see through specimens six times as thick as they can handle at present. The first 1MV machine to be made by GEC-AEI, will be delivered to the Laboratory this year.

Automatic bank cashier: A machine called DACS, the De La Rue Automatic Cash System, developed in the UK, cashes a cheque when the bank is closed. The cheques are special ones for a fixed amount — in Britain, £10. To use the machine, a personal code number is entered on a panel of numbered pushbuttons. Only a genuine number allows the machine to accept the cheque for scrutiny, a process which takes 20 seconds. If the machine is satisfied, it delivers the money; if not, it signals 'rejected' and returns the cheque.

The special cheques can be cleared by the bank in the same way as ordinary ones. While intended to provide a service after banking hours, customers may find it more convenient to use the machine even when the bank is open rather than wait to be served over the counter.

Recovering diamonds: An electronic separator, announced by Gunson's Sortex, London, uses X-rays to identify and recover diamonds from a gravel feed. When irradiated with X-rays, diamonds fluoresce to a high degree, emitting visible light.

This emission is sensed by a photomultiplier in the device, the Sortex XR21. Whenever the light from a particle exceeds a predetermined level, the particle is deflected from the feed into a separate chamber. The unit is claimed to recover up to 99 per cent of diamonds present in a mineral mixture at a single pass through the machine.

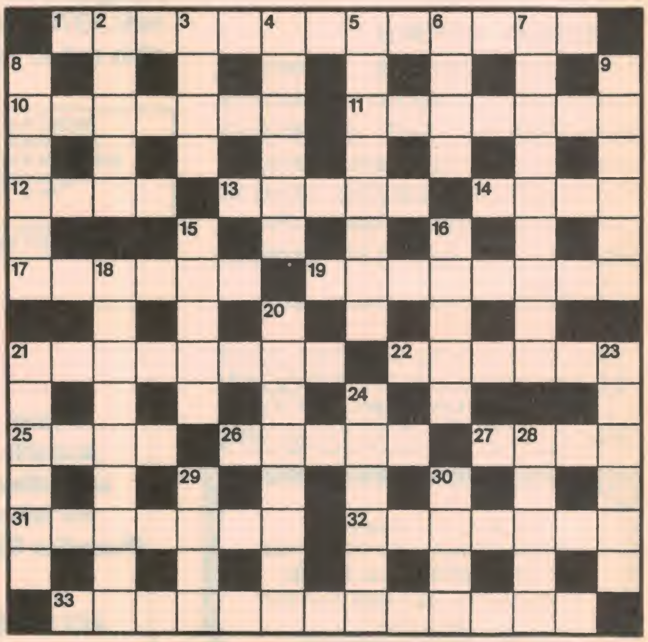
EA CROSSWORD

ACROSS

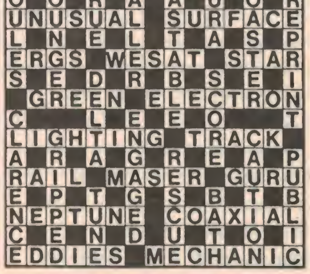
1. Perth-to-Sydney adventurer in solar car Quiet Achiever. (4,9)
10. Volume of communications. (7)
11. Contact point for crystal set, cat's ----. (7)
12. Image on radar screen. (4)
13. Type of diode. (5)
14. Points of convergence. (4)
17. First name of 5 down. (6)
19. Radioactive element number 89. (8)
21. Collecting place for electronic media. (8)
22. Brings components to correct positions. (6)
25. Said of low strength signal. (4)
26. Ferromagnetic material. (5)
27. Crosspiece of a ladder. (4)
31. Mirrors of polished metal as in some telescopes. (7)
32. Physical property of mass. (7)
33. Route of World Solar Challenge. (6, 7).

DOWN

2. Brand of computer games. (5)
3. A gentle setdown on the Moon is a --- landing. (4)
4. Person getting illegal access to data systems. (6)
5. Inventor of the cyclotron. (8)
6. Said of a paired configuration. (4)
7. Ignorant. (9)
8. Having tendency to maintain position. (6)
9. Rare-earth element number 68. (6)
15. Those who utilise hardware, etc. (5)
16. Faces of meters, etc. (5)
18. One who sells magazines such as EA. (9)
20. Factor affecting TV picture. (8)
21. Most modern. (6)
23. Electromagnetic wave. (6)
24. Name of US spacecraft. (6)
28. Part of UHF. (5)
29. Name of series of Russian spacecraft. (4)
30. Interlock as gears do. (4)



SOLUTION FOR JULY 1994



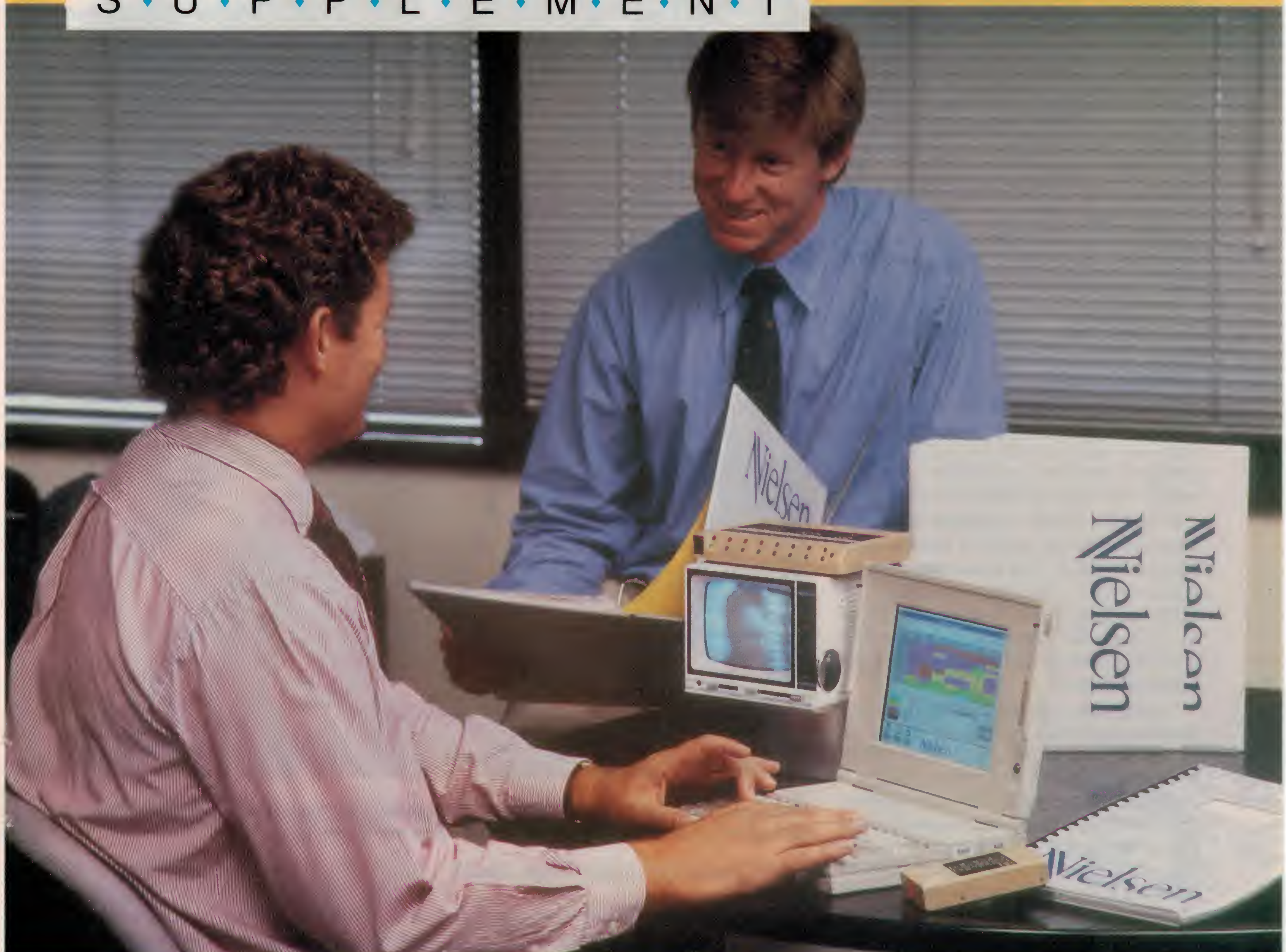
Electronics Australia's

Professional Electronics

S·U·P·P·L·E·M·E·N·T

UNSW NATIONAL PULSED MAGNET LAB SEES NEW ROLE FOR SILICON IN 'NEXT GENERATION' OF SEMICONDUCTOR DEVICES

PROFILE OF A DATA SUPERHIGHWAY LEADER: ORACLE'S CO-FOUNDER LARRY ELLISON



MARKET RESEARCH FIRM A.C. NIELSEN REPLACING ITS MAINFRAME WITH A NETWORK OF 280 COMPAQ PC'S, EXPECTS TO SLASH ITS DP COSTS BY 50%...

NEWS HIGHLIGHTS

NPML SEES NEW ROLE FOR SILICON

Joint research by IBM and the University of NSW at the National Pulsed Magnet Laboratory has identified a path that will influence the direction of UNSW's new Semiconductor Nanofabrication Facility, which will target the next generation of electronic devices — without moving away from silicon.

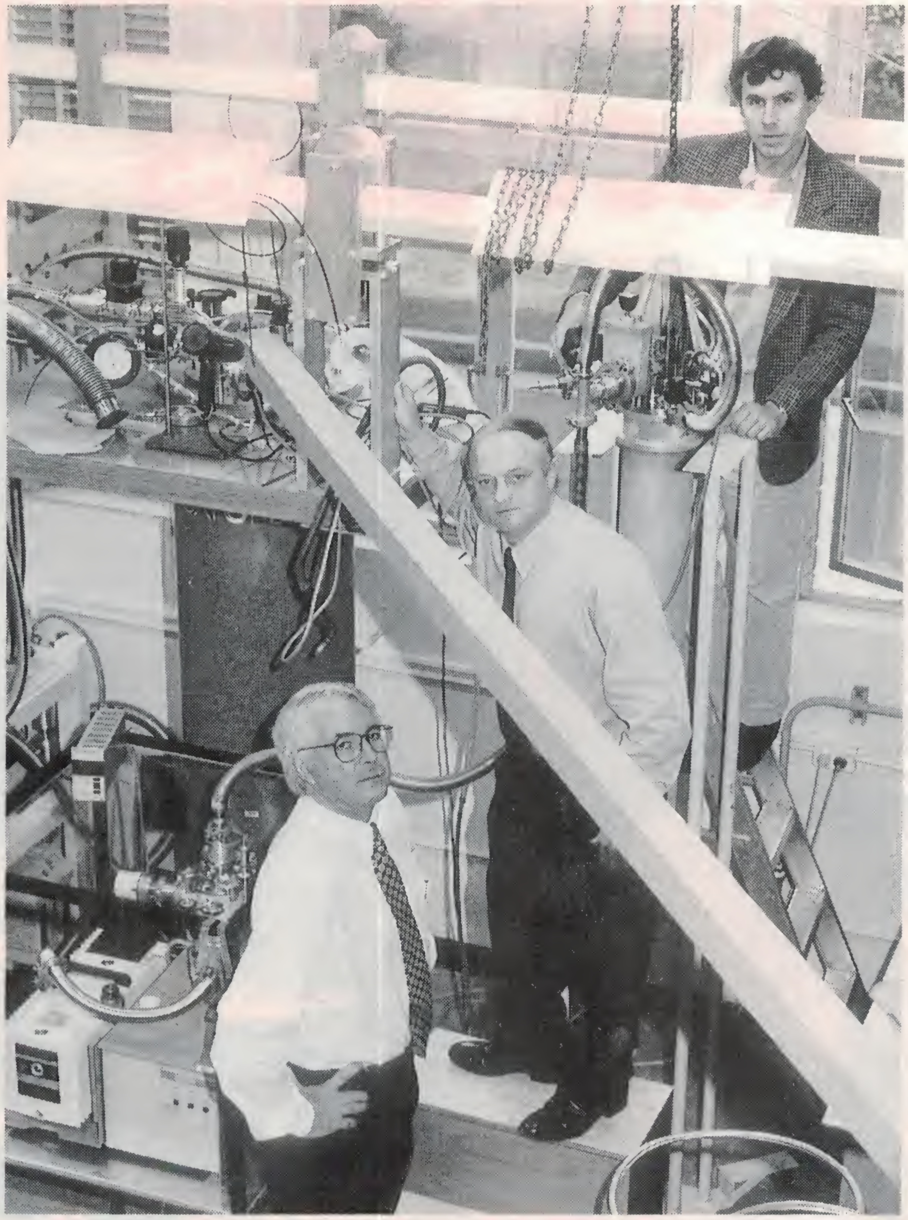
The latest research, by Dr Frank Fang from IBM's main research laboratory at Yorktown Heights; Dr Richard Newbury, Head of UNSW's Department of Condensed Matter Physics; and Professor Bob Clark, Director of the NPML and Professor of Experimental Physics at UNSW, has indicated exciting possibilities for advanced semiconductor structures made from silicon (Si) and silicon-germanium (SiGe).

Dr Fang's recent month-long visit to the NPML was arranged by Dr Greg Clark, IBM's Director of Research in Australia, who has believed for several years that physical conditions at the interface between silicon and a silicon-germanium alloy could be exploited to produce the next generation of super small, super fast electronic devices.

Professor Clark explained that previous gains in the speed of conventional silicon switches had been achieved by making the switches smaller, so electrons had to travel shorter distances to activate the switches, but that this miniaturisation was approaching its operational limit.

"Fortunately, the end of the road for conventional chip technology brings us to the beginning of a path to a whole new assortment of electronic devices," Professor Clark said. The new devices are called nanostructures because their size is measured in nanometres. At this size, they operate according to entirely different rules, in which the wave nature of electrons (quantum physics) becomes important, and in which single electron events can be controlled.

"The path to nanostructures is only now being mapped. The pioneering explorations were done in gallium arsenide (GaAs). These have shown the definite potential of nanostructures, so the general assumption was that nanostructures would be made from these materials.



Pictured at the NPML are (from bottom of photo), Dr Greg Clark of IBM, Professor Bob Clark the NPML's director, and Dr Richard Newbury.

"Now our research and other research is showing that we can take a big cost saving step back from that assumption, because qualities very similar to the qualities observed at the GaAs/GaAlAs interface are now being observed at the Si/SiGe interface," Professor Clark said.

At the GaAsGaAlAs interface electrons are confined to a plane (the so-called two dimensional electron gas or 2DEG). They can be further confined to one dimensional 'wires' or zero dimensional 'dots' by first creating these patterns in metals on the surface of the semiconductor layers using ultrafineline electron beam tools and then electrostatically transferring the pattern to the 2DEG within the layered structure by application of voltages to the metal films (called 'top gates').

Gallium Arsenide has been the material of choice due to the quality of the 2DEG compared to silicon systems.

Exciting new physics has been discovered enroute, using low temperatures and high magnetic fields to probe the critical properties of these man made geometries. These include the quantum Hall effect which now forms our standard of electrical resistance, the formation of an electron solid (Wigner crystallisation), the construction of artificial atoms, new particles termed composite fermions, fractional electronic charge and a potential new standard of electric current by clocking individual electrons at a precise frequency.

The problem to date with silicon-based junctions has been that unlike GaAsGaAlAs, for example, where the atomic lattice spacing of the junction materials is practically the same, Si and Ge have significantly different atomic lattice spacings. In the most advanced structures developed at IBM, 2DEGs with a quality approaching that in gallium arsenide have been produced at a SiSiGe interface. The breakthrough here has been to relieve the strain of SiGe layers grown on a silicon wafer to reduce dislocations and to then grow pure silicon films onto the dislocation-free SiGe.

In this way the strain of the silicon film can be put to good use to modify the interface in a manner that encourages a high quality 2DEG to form.

In recent experiments at UNSW's National Pulsed Magnet Laboratory the fundamental electronic properties of advanced SiSiGe interfaces prepared at IBM have been examined, using the laboratory's intense magnetic fields and very low temperatures.

CLEMENTINE STEERING FAILURE

The US Department of Defense's low-cost space probe Clementine has struck a snag. After encircling the Moon and heading back towards the Earth for a gravity-assisted 'slingshot' boost towards the asteroid Geographos (see Kate Doolan's story, in our July issue), the probe's manoeuvring rockets were ordered to fire indefinitely as the result of a computer fault. This caused all of the manoeuvring fuel to be exhausted, and the on-board cameras can no longer be steered.

DoD officials expected that the craft's main propulsion rocket, which still has fuel, would be used to abort the Geographos phase and move Clementine into an Earth orbit. This would allow limited testing of the other equipment on board.

British firm Neutronics has developed this 'NOSE' (Neutronics Olefactory Sensing Equipment) system, which has 12 sensors capable of registering a distinctive aroma as a unique 'fingerprint' of vapour combinations. The sensors use conductive polymers, which respond to different vapours.

COURSE FOR PAY-TV DISH INSTALLERS

The planned commencement of Pay-TV in Australia this year has drawn attention to the scarcity of trained satellite dish installers. Recognising this, the Australian Antenna Technicians Association has initiated a training course for people interested in providing such a service.

Offered by Moorabbin College of TAFE in Victoria, the course is intended for people who are already antenna installers or who have at least some basic electrical or electronic knowledge. It can be taken over two full days or for four hours over three evenings (one per week).

Further details are available from Moorabbin College of TAFE, 488 South Street, Moorabbin 3189; phone (03) 556 9760.

FIRST 3.5" OPTICAL OVER-WRITABLE DISK

Toshiba Corporation in Japan has developed the world's first high capacity 3.5" overwritable optical disk drive. Data can be simply written to the phase-change optical disk that the system uses, and can also be rewritten by overwriting and either partially or totally deleted. The new drive is claimed as a dramatic improvement over conventional rewritable magneto-optical disk systems, where stored data cannot be changed without first erasing the whole section to which amended data are to be rewritten.

Development of the prototype drive system gives a new impetus to the realisation of storage systems for sophisticated next-generation multimedia systems built around personal computers.

The disk can store and retrieve large volumes of data at high speed, and is the first storage system for personal computers with the capability to record up to 20 minutes of moving pictures in the MPEG2 format on a single disk. Such recorded images have a resolution superior to that of NTSC television broadcast signals, and can be played back in real time.

In Toshiba's prototype system, a double sided phase change optical disk is formed by bonding two disks back-to-back. With a combined capacity of 606 megabytes, the double sided disk offers similar storage levels to the largest capacity CD-ROMs available, and almost five times that of 3.5" magneto-optical disks.

A major breakthrough is the rate of data reading, writing and transfer. At 9.1Mbps this is more than twice that called for by the 4Mbps MPEG2 standard for compressed moving pictures, steadily establishing itself as the de facto standard for moving image compression in advanced information systems.

At a time when attention is increasingly focused on the promise of multimedia

NEWS HIGHLIGHTS

and the ability to manipulate moving images on PCs, the new drive and its 3.5" disk, only the size of a standard floppy disk, leads the way to the flexible and powerful data storage and retrieval capability required to make coming generations of multimedia PCs a reality.

Toshiba is also developing the other enabling technologies for future systems, including a pioneering one chip decoder for MPEG2 signals that allows computers to fully make use of the 20 minutes of moving pictures that the drive can save to a single disk.

DIGITAL PAY-TV CONTRACT SIGNED

A digital Pay-TV service is expected to be operating in Australia before the end of 1994 by operators Australis Media and Continental Century, who have signed a $150 million 10-year delivery contract with satellite owner Optus. It has not been made clear whether the service will be fully delivered to subscribers by satellite, or via a combined satellite/MDS delivery system. However Australis holds a significant number of MDS licences, suggesting a combination of the two delivery systems — perhaps satellite for main 'trunk' distribution, and MDS for local delivery.

CSC INTEGRATING NAVY NETWORKS

A five company team lead by prime contractor and systems integrator CSC Australia has begun installing two Base Area Networks (BAN) for the Royal Australia Navy in Sydney. The contract is worth $2.5 million.

When fully operational, the two BANs will connect several local area networks to Navy's Wide Area Network (WAN), which services all parts of Australia. Connection to the WAN will provide users with access to information held in mainframe mini and personal computer databases in the top layer of Navy's information systems architecture, the Naval Information Network.

Using X.25 communications, the Navy's planned maximum response time is one second. Network standards meet Government Open Systems and GOSIP guidelines.

The BANs are being installed at HMAS PENGUIN, a naval diving school and hospital at Balmoral on Sydney Harbour, and the Missile Maintenance Establishment and Armament Depot at Kingswood near Penrith.

NEW TERMINAL TALKS BACK

Developed in Sydney by General Technology, the GTalk Terminal is a small, flexible display terminal designed to provide a compact and low cost means of controlling, monitoring and communicating with local or remote computer systems using an industry standard serial interface.

A novel feature of the GTalk is the inclusion of an in-built message recording and playback facility, which allows the unit to generate short, clear verbal prompts. These voice messages, or even sound effects or music, might be used to confirm input, acknowledge correct operation or annunciate host initiated events.

One implementation of the GTalk Terminal was for Sydney company Expertech as an automated taxi booking unit. In this application, Expertech's 'Call-A-Cab' terminal links back to a taxi group's base computer via a two way radio network. The terminal takes a booking request at a club/hotel/restaurant and acknowledges its successful transmission by a quick verbal reply.

The terminal's LCD display is used to prompt the doorman or receptionist to help them enter the required information, and it can then automatically issue a ticket number for passenger identification.

The GTalk is designed around a powerful 8-bit microcontroller with up to 16K bytes of PROM and 350 bytes of RAM on-board. It has provision for the inclusion of a variety of internal peripheral devices, which may be optionally loaded during manufacture to tailor the terminal to individual customer requirements.

CABLE TV CONTRACTS TO DEC, S-A

Telecom has made the second key announcement on the roll-out of its $710 million Cable TV (CATV) project to the major residential areas of Brisbane, the Gold Coast, Sydney and Melbourne over the next three years.

Telecom has chosen the Digital Equipment Corporation (DEC) Wizzard Subscriber Management System, while Scientific-Atlanta was chosen to supply customer set-top units for the inital network roll-out which was to begin in July.

The contracts for the Subscriber Management System, supply of set top units and associated equipment are worth about $90 million of the three year network program. These follow Telecom's previous announcement that Philips would be the prime vendor, systems integrator and provider of the core network for the CATV project.

The Subscriber Management System controls channels and stores customer related information, while the set top units decode the cable TV signal for reception on standard television sets.

Both of the contracts will be awarded through Philips in its role as system integrator. The set top units and subscriber management system form part of the

NEWS BRIEFS

- The ***Wireless Institute of Australia*** has a new postal address: PO Box 2175, Caulfield Junction, 3161.
- Following similar arrangements in other countries, ***Rohde & Schwarz (Australia)*** has signed a distribution agreement with Japanese instrument supplier ***Advantest Corporation.***
- The Sydney operations of ***Yamaha Music Australia*** have moved to 680 Willoughby Road, Willoughby 2068; phone (02) 958 6560, fax (02) 958 6762. The warehouse is located at Unit 7, 159-163 Mitchell Road, Alexandria 2015; phone (02) 516 4166.
- ***Astro-Med*** of Rhode Island USA have appointed ***Metromatics*** as sole distributors in both Australia and New Zealand for their range of data capture recorders.
- ***Amalgen Control Systems*** have been appointed distributors for ***Toptec Controls*** and ***APCS.***
- Mr John Legere has been appointed as president and managing director of ***AT&T Communications Services Group*** for the Asia Pacific region.

$710 million investment approved by the Telecom Board in April, which signalled what was claimed as the founding of Australia's information superhighway.

SUCCESS & RECOGNITION FOR NAVAL RADIO CLUB

Last December members of the Australian Naval Amateur Radio Society (ANARS) took part in the annual International Naval Contest between all the 'Navy' clubs in the world. A flag-waving exercise designed to put Australia on the map in this activity, it was an unqualified success.

On a per-capita basis, the ANARS has proved itself to be the second most active naval amateur radio club in the world. Participating clubs were the British RNARS, Dutch MARAC, German MF-Runde, Italian INORC and the Roumanian MARC. Despite the rather poor radio conditions prevailing at the time of the contest, ANARS members came first and second world-wide in the voice section, fifth world-wide in the combined voice/Morse section and were highly placed in the ferociously contested Morse section.

As a result the committee which organises the International Naval Contest has invited ANARS to host the world-wide event in 1995 and again in our centenary year of 2001. This is an honour which the ANARS has gladly accepted.

Membership of the ANARS is heading toward 200 and anyone interested can contact the hon.Secretary Terry Clark at 467 McKenzie Street, Lavington NSW 2641 or by telephone on (060) 253 292.

JAPAN'S MOBILE MARKET OFFERS OPPORTUNITIES

The Japanese Mobile Communications market will demonstrate very high growth rates over the next decade, offering opportunities to Australian suppliers, says a new study by BIS Shrapnel.

The study, Mobile Communications in Japan, forecasts that the number of mobile telephone users in Japan will increase by 160% from 2.3 million to six million, over the next few years.

The number of pager users is also expected to increase from 7.3 million to 11 million by 1998.

Researcher and author Vanessa Makris notes that since late 1993, the Japanese Government has been promoting imports in order to improve the standard of living. "The government hopes import deregulation and promotion of industry competition will lower prices and improve products and services as well as offering services to outer areas which have been neglected."

AUSTRALIA TO MAKE CHINA-KOREA CABLE

Alcatel TCC, Australia's optical fibre submarine systems specialist, has won a new export order to supply a turnkey optical fibre undersea cable system, linking China and Korea.

Valued at $48 million, the contract for the China-Korea Submarine Cable System (known as CKC) was awarded by the Directorate General of Telecommunications (DGT) part of the Ministry of Posts and Telecommunications (MPT) of China, and Korea Telecom. It will run from Qingdao, in China's Shandon province, to Taean, south of Korea's capital Seoul.

Speaking at the contract signing in Beijing, Alcatel TCC Chairman Bill Page-Hanify commented that the company is now one of Australia's global enterprises and his latest success shows how well it is competing around the world for a share of the dynamic telecommunications market.

The length of CKC is 550km, with three optical repeaters. It will operate at 560Mbit/s, over two fibre pairs, and is scheduled for service by November 1995. Cable will be manufactured at Alcatel TCC's Port Botany site, with repeater production taking place under Clean Room conditions at Liverpool, in NSW.

The entire length of cable will be armoured and deeply buried, to minimise risk of damage from the vast number of fishing trawlers operating in the Yellow Sea between China and the Korean peninsula.

LA BUSES TEST OZ SMART CARDS

Australian firm Intag International Limited's US associate company Racom Systems, Inc., has announced that it is participating in a trial of advanced automatic fare collection technology and IVHS systems (Intelligent Vehicle Highway Systems) for public buses. Field tests began on May 10 in three Californian cities: Gardena, Los Angeles, and Torrance. Racom's contactless smart cards, known as the In-Charge Card, are being used to automatically debit bus fares simply by waving the card in front of the fare collection terminal while boarding the bus.

The In-Charge smart card uses radio signals that respond to specific commands from the on-bus fare collection system during passenger boarding. "This is one of the first wireless electronic payment systems to go on-line in the world," comments Ross Lyndon-James, Managing Director of Intag International Limited.

"By embedding a highly specialised computer chip and an antenna inside a plastic card, we have created an electronic means of replacing cash, tokens, and tickets. The whole process of boarding a bus and paying is faster and easier for passengers and operators alike," Lyndon-James added.

The concept is to use the fare collection system as the core of an advanced passenger transaction and vehicle monitoring system. The goal is to improve bus operations and passenger convenience, reduce operating costs, and increase revenues.

The test in southern California will also involve automated vehicle location, transfer and receipt printing, voice annunciation of stops and passenger data collection.

The LA project follows Intag's earlier announcement of a mass transportion project in the city of Manchester, England. Other cities evaluating contactless smart cards for a regional payment system include Ann Arbor, Hong Kong, Tokyo, Paris and London.

AT&T TO ESTABLISH LOCAL R&D CENTRE

AT&T Australia has announced the formation of a local research and development centre, which will design software for the global market. Over the next three years AT&T will invest more than $3.5 million in the centre, which will initially employ 10 people.

The announcement was made by the Managing Director of AT&T Global Business Communications System (GBCS), Mr Tim Wilson, who sees significant opportunities for AT&T to develop software products for the local and export market.

AT&T GBCS, the division responsible for the sale and support of the Definity multimedia voice, data and video switch, has been conducting research and development in Australia using third party software developers to meet the needs of its local customers. With the continuing growth of its business in this country, the demand for a more formalised research and development facility has grown.

The formation of a local AT&T research and development facility will complement the existing third party software development activity. ❖

SPOTLIGHT ON SOFTWARE

Speaker System Designer

Australian-based Bodzio Software has produced an economical but sophisticated loudspeaker design package, which runs in the familiar *Windows* environment. Available in both low-cost or 'professional' versions (V4.0 or V4.22), it offers full enclosure modeling, compensation and crossover network analysis, a box positioning utility, and several optimising routines.

by ROB EVANS

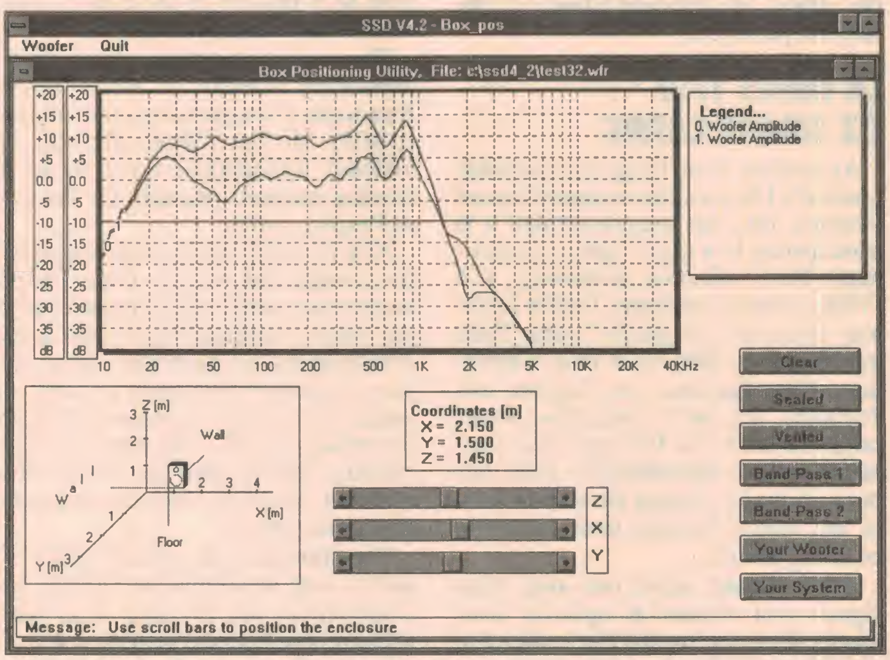
Over the past few years we've been fortunate enough to have access here at *EA* to the excellent *LEAP* loudspeaker design software, and have put this package to good use during the development of several speaker projects. In essence, this type of CAD software quickly allows you to design, evaluate, and fine-tune a speaker system *before* building the enclosure (or crossover network), thereby saving substantial amounts of both time and money during the development process.

During this period however, we've received a steady flow of letters and calls from readers along the lines of: "I have driver XYZ with the following parameters, and could you design me a suitable enclosure using your LEAP software?".

While not unsympathetic to these requests — being a professional CAD package with a matching price, *LEAP* is beyond the reach of many readers — we've rarely been in a position to help, due to the time constraints involved in producing the magazine.

Bearing this in mind, we were particularly keen to take a look at *Speaker System Designer* (SSD) from Bodzio Software, which at a basic price of just \$99 (the 'base' configuration of V4.0) appears to be great value for home loudspeaker designers. And to further fire our interest, SSD is an ***Australian*** Windows-based program...

Both versions of SSD (4.0 and 4.22) run under *Windows 3.1* and require a '286-based machine (or better), 2MB or more of system RAM and a suitable mouse. This is not particularly demanding by todays standards, and SSD should suit most machines. The fully optioned versions will take up around 3MB of your hard disk space, and are installed under *Windows* from four 3.5" floppy disks via the usual SETUP program.



The full versions SSD are arranged in a slightly unusual 'modular' form, where each major part of the package is configured as a independent executable program with its own *Windows* icon, and uses the same data file format.

The idea is that the various modules are used in a *sequential* manner, much in the same way that a set of tools might be applied in a production line chain. The following overview refers to SSD (V4.0 and V4.22) in its full version, and we'll cover the limited, low-cost versions later.

The first *Editor* module accepts the raw driver data in the form of both speaker parameter (Qts, Fo, Vas, and so on) and a frequency response plot (level in decibels at discrete frequencies), allowing the user to develop and save a speaker library for later use. SSD then has a novel arrangement where the user simulates the driver's complex transfer function by 'tracing' its response plot, through nominating various roll-off points and slope rates — this creates an electrical 'model' for later analysis routines.

This saved data is then available for the next *Box* module, which is used for loudspeaker enclosure design. By entering the basic box parameters such as internal volume, Q-factor and tuning frequency (for vented enclosures), the system will compute and plot the system's theoretical performance. The curves include frequency response, system impedance and cone-excursion (phase plots are available in V4.22, but not V4.0).

A 'parametric' feature is also available, which produces multiple plots showing the effect of varying a key box parameter

(say, internal volume) over a predetermined range. The process can then move onto the *Compens* module, where compensation networks can be developed to improve the performance of the current driver/box combination, which has been saved as a single design file. Here, networks can be arranged to compensate for voice coil inductance, impedance peaks, phase shifts and driver sensitivity, while the usual response plots are available to view the results.

After that, the outcome can be applied to the *Crossove* module which allows the designer to develop a suitable crossover network for the system. Bullock, Butterworth, All-pass and Linkwitz-Riley networks are supported, and again you can view the results via the full range of response plots.

By the way, both the Compensation and Crossover modules use a schematic capture technique during network development, so you can actually see the circuit involved, instead of just a list of simulation parameters.

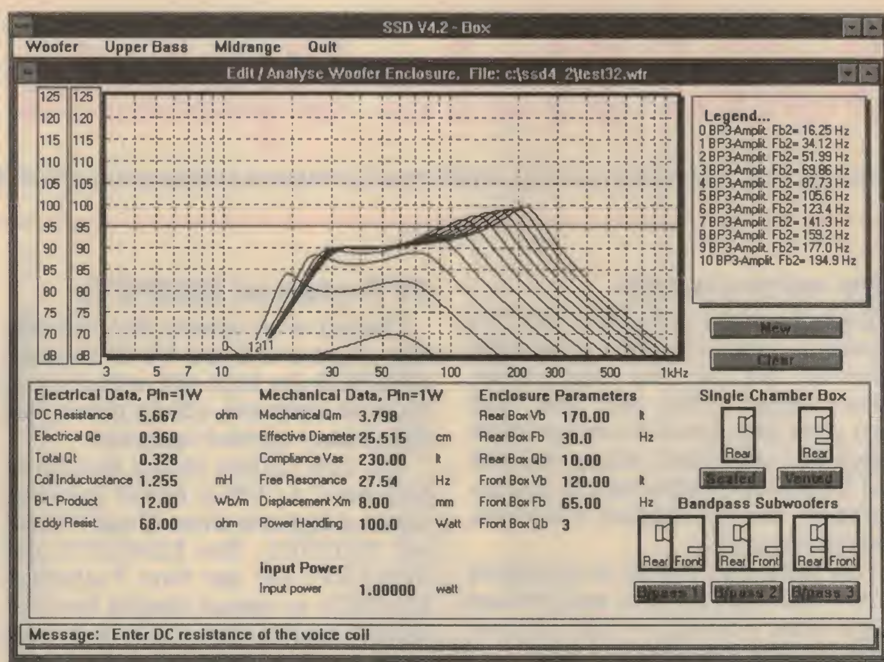
The final speaker system design is then passed on to the *Sum_plot* module, where the user can view the overall results of their efforts. Here, all of the design factors can be brought together and saved as a 'project', and a range of plots produced for the complete system. Multiway speaker systems can be built up by combining individual driver/ enclosure/ crossover combinations, and the effects of driver positioning and phase reversal observed.

Finally, a speaker design can be applied to the *Box_pos* module to estimate how the system's low-frequency response will be effected by the listening room. The enclosure in question can be positioned at up to three metres from the corner of the room in all three dimensions, and the result plotted on demand.

Besides the basic 'sequential' range of modules, the full versions of SSD also offer three optimising modules which are intended to enhance or fine-tune the results from the *Box* and *Crossove* programs.

The *Box_opt* module optimises the enclosure design by continuously varying the three major box parameters (Vb, Fb and Qb) until an 'optimally flat' alignment is reached. In practice, the program first plots an idealised response for that driver (for a sealed or vented box), then progressively varies the enclosure parameters until that target is reached.

You can also fine-tune the system's crossover network with the *Filt_opt* module, which in the same fashion as above, varies key network components to achieve a target response for a given



driver/enclosure/network combination. Similarly, the *Cros_opt* module provides further fine-tuning for the overall system (rather than for an individual driver system), allowing the user to automatically compensate for driver interaction in a multiway setup.

Each module of SSD operates pretty much in the way that you'd expect from a *Windows* program, with pull-down menus, editable dialog boxes, and high resolution plots appearing directly on the current screen (or active window, in *Windows'* terms). It uses the currently selected *Windows* printer routine as you'd also expect, and all functions operate under mouse or keyboard control.

Other features of the package include the ability to design and analyse three types of bandpass enclosures, a thermal analysis routine for showing the power compression effect of an increase in a driver's voice coil temperature, and the capability for importing IMP driver data files. This latter feature is particularly handy, since SSD's Editor module requires a driver's frequency response plot, as well as the usual driver parameters (Qts, Fo, and so on).

If you don't have access to an IMP (or similar) testing system though, some users may find SSD's method for constructing its own driver 'model' is little a awkward, since it relies heavily on data supplied by the speaker's manufacturer. While many speaker suppliers can provide the basic 'Theile/Small' parameters (Qts, Fo and Vas) for a given driver, SSD really requires a sizable list of figures *plus* a frequency response plot for the driver in a known cabinet. Once you have the data however, it's a very simple matter to enter the figures and manually reconstruct the response plot — this is done by 'clicking' on each point to draw the response graph, or again, manually entering the data.

The fully optioned versions of SSD are priced at $199 for V4.0 and $299 for the enhanced V4.22. The latter 'professional' version includes extra features such as an enhanced screen display (it requires an 800 x 600 pixel *Windows* screen driver), greater accuracy and resolution (more data points in each analysis), an improved thermal routine, the ability to analyse the effects of driver positioning on the front panel, a range of phase plots, plus other refinements.

The economical 'base' systems of SSD are priced at $99 for V4.0 and $149 for V4.22, and only include the *Edit* and *Box* modules. With this setup, the user can fully design enclosures (sealed, vented, etc.,) for any speaker — including midrange drivers — and display, plot and print out the results in the normal way. While this restricts the design of crossover networks and multiway speaker systems, we suspect that the minimal SSD setup may well satisfy a large range of home loudspeaker designers.

All in all, we found SSD to be a very interesting and useful package — the parametric plotting routines were very instructive in enclosure design, for example.

While it's not without a few operational quirks, most users should find it quite easy to drive and will appreciate the common *Windows* environment.SSD comes equipped with a comprehensive ring-bound users manual, and is available from ME Technologies at PO Box 50, Dyers Crossing, NSW 2429; phone (065) 50 2200, or fax (065) 50 2341. ❖

Low noise op-amp

Burr-Brown's new OPA124 is a precision, monolithic FET operational amplifier that has low bias current, noise, voltage offset, and drift, with high open loop gain and common mode rejection. Applications include analytical and laboratory instrumentation, data acquisition, test and medical equipment, and optoelectronics.

Low input bias current is maintained over a wide input common mode voltage range. Laser trimming of thin-film resistors gives very low offset and drift.

Key specifications include: 6nV/√Hz (10kHz) voltage noise, 1pA bias current, 2uV/°C drift, 120dB (min) open loop gain, 100dB common mode rejection, and 250uV offset. The device is available in 8-pin plastic DIP and SOIC packages.

For further information circle 272 or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 878 2700.

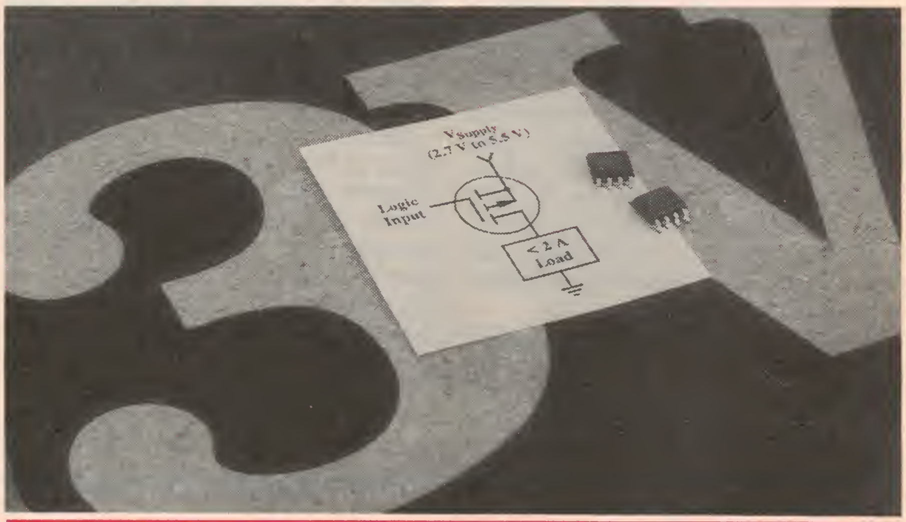
3V P-channel MOSFETs

Claimed as an industry first, Siliconix has announced its 3V P-channel MOSFETs for high side switching in notebook computers, cellular phones, and other battery operated equipment.

The new surface mount devices in Siliconix' LITTLE FOOT package replace a high side driver IC and N-channel MOSFET. The Si9433DY and Si9933DY are the first P-channel MOSFETs to operate directly from 3V supplies, making them suited for the next generation of portable computers, instruments, and cellular telephones.

On-resistance at 2.7V is 0.10 ohm for the single P-channel Si9433DY and 0.20 ohm for the dual P-channel Si9933DY. With their low 1uA maximum drain-to-source leakage current, the new devices draw eight times less power than a typical high side driver IC and N-channel device. While both devices are optimised for operation at 3V, they have improved performance in 5V systems. At 4.5V, on-resistance for the Si9433DY is 0.06 ohms, with the dual Si9933DY offering 0.10 ohm.

For further information circle 271 on the reader service coupon or contact IRH Components, 1-5 Carter Street, Lidcombe 2141; phone (02) 364 1766.



200MHz RISC CPU

Toshiba has announced its R4400 RISC MPU line up, the 64-bit microprocessors based on architecture developed by MIPS Technologies.

The new MPUs are fabricated using 0.3 micron CMOS processing technology. They have a 200MHz internal clock speed and 100MHz external clock speed, a performance some 30% faster than the 150MHz internal clock speed of the company's current RISC devices. Low power consumption is achieved by 3.3 volt operation.

The new processor is available in three versions: TC86R4400PC-200, the TC86R4400SC-200 and the TC86R4400MC-200. The PC device supports primary cache memory while the SC supports both primary and secondary cache memories. The MC supports both secondary cache memories and multiprocessor systems. PC will be available in a pin-grid-array (PGA) 179-pin package while SC and MC will be offered in 447-pin PGA packages.

Toshiba entered into a licensing agreement with the US company MIPS Technology in October 1991 to design, develop, manufacture and market MPUs based on MIPS RISC technology.

For further information circle 278 on the reader service coupon or contact Toshiba Australia, PO Box 350, North Ryde 2113; phone (02) 887 3322.

A/D and D/A chips for TV signals

Pixel Semiconductor, a subsidiary of Cirrus Logic, has announced low cost devices for decoding analog TV signals to the digital format needed by a computer, and encoding the digital signal from a computer for playback on a television screen or recording to a VCR. The CL-Px4070 TV-IN decoder and the CL-Px4080 TV-OUT encoder bridge the gap between the analog TV/video standards and a computer's digital video standard. They also provide an alternative to multi-chip encode and decode schemes. The TV-IN and TV-OUT chips interface directly to Cirrus Logic's current family of video processors. They also provide an alternative to multi-chip encode and decode schemes. The TV-IN and TV-OUT chips interface directly to Cirrus Logic's current family of video processors.

The CL-Px4070 TV-IN, a single-chip multi-standard TV decoder, combines the functions of a video digitiser and video decoder in a single chip. It is designed to accept and digitise NTSC, PAL or SECAM input from a TV tuner, VCR or camera, and convert the information to the digital YUV format needed by a computer. The 16-bit output bus can be connected directly to a video processor, like the CL-PX2070 or PX1070 or graphics display device like Cirrus Logic's Alpine family of GUI accelerators.

The CL-Px4080, a multi-standard en-

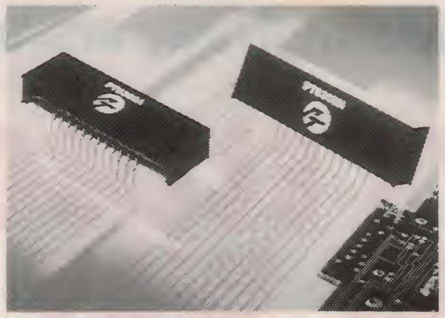
coder, reverses the process. It takes the RGB or YUV output from a computer application and encodes it for playback in the NTSC, PAL or SECAM format needed by a TV set or VCR. The CL-Px4070 is priced at US$21 in 50k quantities. The CL-Px4080 will be available for US$15 in 50k quantities.

For further information contact Cirrus Logic, 3100 West Warren Avenue, Fremont CA 94528 USA; phone (510) 623 8300, or fax (510) 226 2240.

5V to 3.3V switching regulator in SIL pack

Power Trends have released a high performance 5V to 3.3V, 3A 12-pin, single-in-line package (SIL) integrated switching regulator. The device is specifically designed for onboard power conversion for 3.3V logic families and systems.

The PT6305N solves the problem of integrating new low power 3.3V logic ICs into existing 5V systems without



redesigning the power supply. It operates at 650kHz and features excellent line and load regulation.

The unit has a low profile measuring 51 x 15.2 x 9mm. Features include 85% efficiency, input voltage range from 4.5 to 10V, over-temperature protection, and internal short circuit protection.

For further information circle 273 on the reader service coupon or contact Alpha Kilo Services, 1/144 Burns Bay Road, Lane Cove 2066; phone (02) 428 3122.

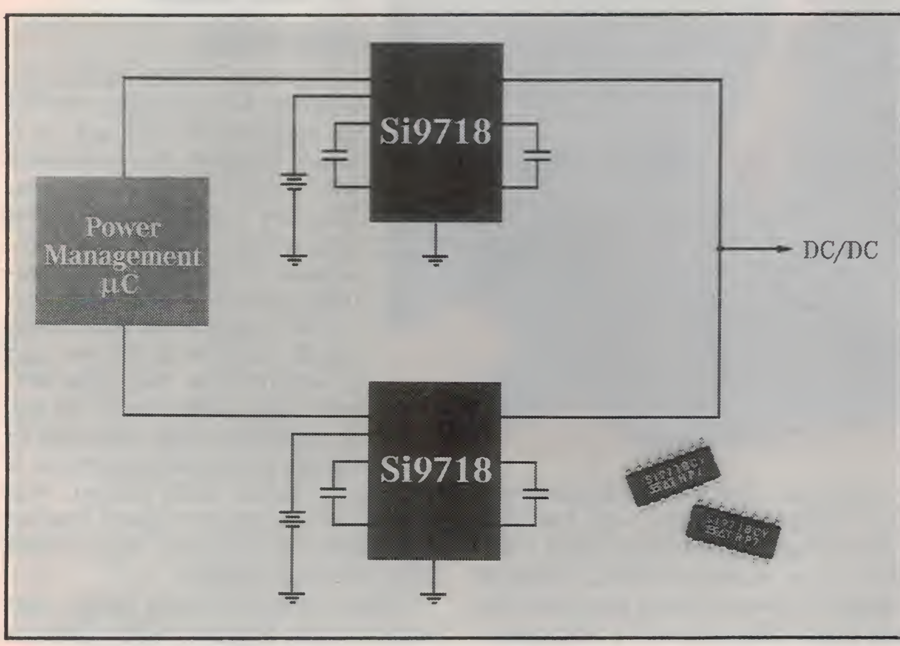
Reverse blocking switch

Siliconix has released a switch for battery disconnect applications. Replacing two MOSFETs and associated drive circuitry, the Si9718CY is for dual battery notebook computers, simplifying power supply designs, improving battery life and giving users more flexibility.

The switch eliminates a problem common to many dual battery pack devices, by allowing the computer to switch from one pack to another before battery cells are completely discharged. The device also suits designs that allow auxiliary power sources, such as from automotive cigarette lighter sockets. The reverse blocking component of the Si9718CY eliminates the parasitic diodes common to standard MOSFET technologies, reducing both parts count and device on-resistance. Rated at 0.08 ohm and 3.5A, the Si9718CY also includes charge pump and enable circuitry. For safe power-down, undervoltage lockout circuitry protects the system by shutting down in the open switch state.

The device has been optimised for eight to 10 cell battery applications, and is tightly specified for 6V to 18V applications. It comes in an SO-16 package.

For further information circle 275 on the reader service coupon or contact IRH Components, 1-5 Carter Street, Lidcombe 2141; phone (02) 364 1766.



100MHz, 20ns RGB video switches

The MAX463-MAX466 from Maxim are a new series of two channel 100MHz video buffers with high performance switches.

These devices replace discrete switches and multiple amplifiers to provide a single IC that switches between two RGB (or RGB sync) sources in less than 20ns and directly drives 50 ohm or 75 ohm cables.

Specified for +/-5V supply operation, the MAX463-MAX466 guarantee an output drive of +/-2.5V into a 75 ohm back-terminated cable (150 ohm).

The MAX463 and MAX464 buffers have a fixed gain of unity and the MAX465 and MAX466 have a fixed gain of two for 75 ohm back-terminated applications.

For low power applications or applications that require routing more than two RGB sources, multiple RGB switches can be paralleled together to form larger arrays. Three digital input pins control the channel selection and the amplifier state (on/off).

Input capacitance is 5pF and the channel-to-channel crosstalk is better than 60dB at 100MHz. The onboard amplifiers feature a 300V/us slew rate, and a bandwidth up to 100MHz.

The devices come in 24-pin DIP and wide SO packages, and are screened for commercial (0°C to +70°C) and extended industrial (-40°C to +85°C) temperature ranges.

For further information circle 274 on the reader service coupon or contact Veltek, 18 Harker Street, Burwood 3125; phone (03) 808 7511. ❖

Profile of a data superhighway entrepreneur...

ORACLE'S ELLISON LEADS THE WAY

US software firm Oracle Systems made its name in high performance database packages, and is now a leading player in the rush to develop the software needed to manage the newly-emerging 'data superhighway' — expected to link the world's TV sets, computers, broadcasters and publishers in a vast, instant-access network, in the next few years. Here's a profile of Oracle's dynamic co-founder and chairman Larry Ellison, who has dragged his company to the forefront of this fast moving technology.

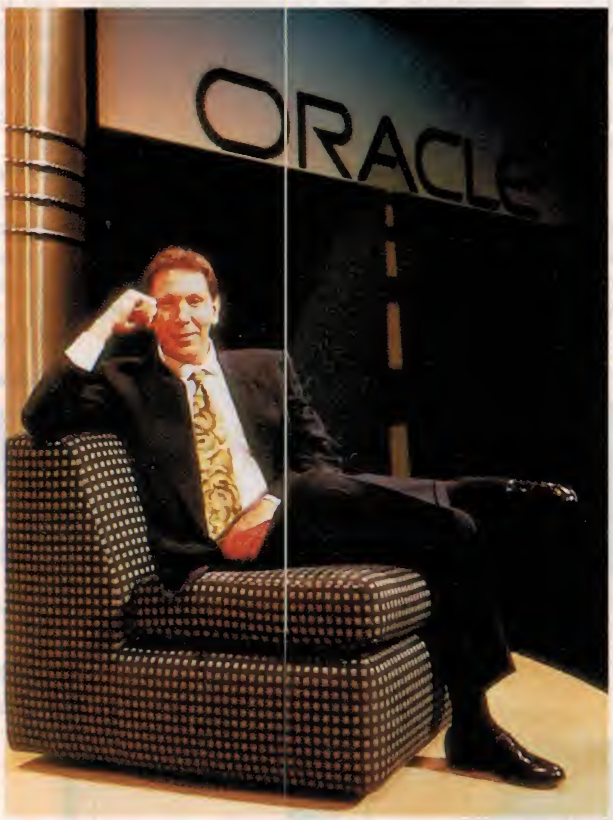
by RORY O'CONNOR

Los Angeles, February 15: On stage at the CBS television studios in Burbank is Larry Ellison, chairman of Oracle. Ellison is launching his software company into the brave new age of interactive television and information superhighways, offering to provide the critical software that will be needed to make the networks operate and offer hundreds of new services to consumers and businesses.

To demonstrate some of what the future will bring us, Ellison uses an advanced remote control device to order a movie from a TV on-screen menu. From the category menu (thrillers, action, romance, science fiction, etc.,) he selects 'action', and subsequently selects Sylvester Stalone in Cliffhanger. Next, Ellison clicks through other choices on his screen to order a large pizza. The delivery boy asks Ellison for a tip. It's included in the credit card bill, which Ellison fills in on the screen.

Moments later, Ellison's secretary appears on the TV screen reminding him to get a gift for his mother's birthday. Ellison clicks through the woman's section at Macy's: sportswear — sweaters — cashmere — gray — regular. (His mother is really a 'large', he explains, but she doesn't like to be reminded, he jokes...)

The performance was vintage Ellison strategy: sketch a grandiose vision, sell customers on the promise that he is the one to deliver it, and then scramble like hell to live up to the expectations he has created.



So far his strategy, notwithstanding a few bumps along the way, has succeeded magically, creating a US$1.5 billion a year worldwide market leader in database software. Along the way it has also made Ellison himself a billionaire.

But as successful as Ellison's strategy has been, it has hurt him in the past as well. In the late 1980's, for example, his promises outstripped what he could deliver and it nearly cost him his company.

As he pushed for a competitive edge in the market for database software, customers complained that Oracle's software failed to live up to the company's hard sell marketing claims. Uncollected debts piled up. By March 1990, the company's stock slid as earnings were revised downward. It took many months for a new team to turn Oracle around.

New vision

This time, Ellison insists, it's different. He is working to shed his image as the 'bad boy' of a tough industry, the hardballer who wanted to win at any cost. The new Larry Ellison is not only selling a vision, but a reinvention of himself as a cooperative leader of the interactive age.

If he succeeds on both fronts, Oracle could be to the new age of information and entertainment what IBM was to the age of mainframes and Microsoft to the age of personal computers. It will almost surely make Ellison, who grew up as the adopted son of Russian immigrants in Chicago's tough South Side, an industry legend.

Ellison's new vision and image were born in late March 1990. Ellison

secluded himself for three days in his US$2.5 million home. To this day, he has not revealed what went through his mind during his self imposed retreat. But surely he had time to think about how far he had come — and how fast his company was falling.

For more than a decade, Ellison had seen his company nearly double sales each year, its workforce mushrooming from four to nearly 2000. Then, with earnings down and Wall Street's confidence shaken, he watched his stock go free fall.

Ellison wasn't used to failure. The college drop-out who teamed with his former boss at Ampex to start Oracle, shunning venture capitalists' offers of help, had become a millionaire many times over. He had built his company by offering software based on an IBM-pioneered design he had found in a technical journal. It allowed users to retrieve and sort all forms of corporate data in a radically different and faster way.

Ellison recruited bright young men and women from the top schools. He rewarded them with good pay, loans, a health club, a subsidised cafeteria and offices in Oracle's glass headquarters. And he pushed them hard — sometimes out the door.

Tough manager

Current and former employees all say they admire his intelligence and vision. Many also feared him. He was, recalled Smokey Wallace, a former vice president who reported to Ellison from 1988 to 1992, "a stress generator. He's a gun shooter in the Old West paradigm," said Wallace, who quit when he feared he would be fired. "If he feels any threat, he shoots."

Michael Leibowitz, editor of *UPside* Magazine, described an Oracle rating system set up to routinely flush out the bottom 10% of Oracle's sales force.

Ellison once had police arrest as a prowler, a legal messenger, serving papers in a lawsuit filed by stockholders of a company he had bought — but for which he had stopped making payments.

Ellison's aggressiveness caught up with him as the 80's closed. Oracle's sales force, driven by him, had sold more than it could deliver. Customers complained that Oracle promised performance that never materialised, then asked them to pay for more software to fix the problems. After hitting a record high of US$28.37 per share early in March 1990, Oracle's stock spiralled downward at the end of the same month as the company reported its first ever quarterly loss.

Share turnover set a single day NASDAQ record; banks threatened to call in loans. Shareholders sued, claiming Oracle's officers and directors had artifically inflated the price of the company's stock by misrepresenting its financial condition. Oracle would eventually settle for more than US$23 million.

By September 1990, Oracle stock had bottomed out at US$6.88 a share. A Securities and Exchange Commission complaint, filed in 1993, alleged that between June 1989 and November 1990 the company's internal accounting system had been wildly out of control. Customers had been routinely double-billed, the agency's investigations revealed, and some received invoices for work never performed. Oracle paid the government a US$100,000 fine.

Oracle recovers

By then, Oracle was again on the ascent, and Ellison was a changed man. He had emerged from his three days of seclusion in 1990 to institute financial controls, bring in veteran managers and loosen his iron-fisted grip.

Key investors and lenders insisted Ellison bring in respected executives as a condition for obtaining additional financial support. Ellison, who owns nearly a quarter of the company's stock, survived the shake-up.

The turnaround has been remarkable. Revenues topped US$1.6 billion in fiscal year 1993. Earnings were US$142 million. The company has more than 10,000 people. Oracle's stock has risen to around US$68 (when compensated for a recent 2-for-1 split). Ellison's 22.9% of the company's stock is now worth more than $2 billion.

Today, the symbol of the new Oracle is its recast guiding spirit: Larry Ellison.

These days Ellison, once nicknamed 'The Shark' by a Silicon Valley magazine, tells reporters the arrogance of the old Oracle was 'unnecessary'. And he refers to the new Oracle as a group of 'reformed sinners."

These days the man who once refused to shake hands with a competitor at an industry dinner, talks of the need for cooperative agreements. It was after unveiling 21 agreements with companies including Bell Atlantic, the Washing Post and Apple Computer, that he took the stage in Los Angeles.

"It was a painful but useful experience," Ellison's friend, former Apple executive Jean-Louis Gassee, said of Oracle's roller-coaster ride. "It's given him some perspective on what it's like to go from the penthouse to the doghouse and back."

Back in the penthouse, Ellison is once again becoming a darling of the financial community. Oracle recently was the subject of a cover story in *Fortune* and got prominent play in *Newsweek.*

Of course, the kinder, gentler Ellison remains an astute businessman, as one of the agreements announced in Los Angeles certainly suggested.

Although Oracle has promised that its media server software eventually will work on conventional computer systems, for now its new software for interactive television works on just one system — that for Foster City based computer maker Neube. The company is controlled by Ellison.

Oracle's technology needed

For all the talk of change, Ellison again is marketing confidence itself, pushing his products to be first on the market. Only Oracle has promised an integrated, end to end solution to the challenge of making interactive television work.

His sales pitch gets a receptive audience from the titans of the telephone and cable companies — who have committed billions of dollars to building the fibre-optic pipelines to deliver Interactive television, and are now desperate for an operating system that works.

Recently Oracle announced that the company had been chosen to provide the software for a test of interactive television by British Telecommunications PLC.

Ellison's message is also welcomed by manufacturers, whose products depend on the development of a common software standard for the chaotic new industry.

"He's a smart salesman, and he understands the sales cycle, "said Bruce Ryon, a multimedia analyst with Dataquest. "What he's saying is, 'The software doesn't really exist today, but we can put it together for you' ... He's got to get them locked in."

Ryon however, worries that Ellison may be invoking history to repeat itself. "He did this in the late 1980's, got over extended and didn't meet the delivery schedule. In the analyst community, we're asking, 'Is this the late 1980s all over again'."

For now, the benefit of the doubt seems to be with Ellison, others say — pointing to the array of top level industrial giants that have lined up behind Oracle's data superhighway technology.

And no one doubts that Ellison will make sure his company doesn't miss the boat on the potentially huge market — or that he will end up being its captain. ❖

Silicon Valley NEWSLETTER

IBM researchers make multilayer CDs

Imagine every Clint Eastwood movie, the Star Trek series, (movies and TV episodes), or the entire collection of Beatles music (group and solo) — all on a single CD! That is what researchers at IBM's Almaden Laboratory in San Jose are envisioning will happen in the next couple of years, thanks to a technology they have developed that could stack as many as 30 CDs together in a package only slightly thicker than today's standard CD and which can be read by a CD-drive as a single CD.

The technology is based on the concept of stacking a number of paper-thin, clear CDs on top of each other and using a sophisticated laser playing head that adjusts its focus to read only the data it needs from one of the discs in the stack.

Until now researchers have assumed that CD playing heads needed the mirror backing on the CD to help read the laser light reflected by the pits on the surface of the CD. But the IBM researchers found that even a completely clear disc reflects enough of the light to be read accurately, as long as some special adjustments are made to the playing head.

The researchers also found that enough of the laser light would be passed on to further discs to be able to read the data on them. By quickly adjusting the focus of the beam, the researchers were able to quickly change from disc to disc or layer to layer.

Of course, as the light passes through the stack of discs, the pits on each layer reflects some of the laser light. But Hal Rosen, who manages the 'Novel Recording Studies' program at the IBM lab, said his team was able to filter out this 'noise' from the other disc layers.

So far, Rosen said, his team has produced working models for stacks with up to six layers. He said additional work is aimed at producing drives with 20 - 30 CDs bundled together. Because each layer is about as thick as a sheet of paper, a 30-CD stack would measure about the same in thickness as today's audio CDs.

Rosen said even a stack of only two CDs maintains enough storage space for a full length movie. Larger stacks could thus contain entire collections of work. He also said that so far the technique has proven to work for both read-only and the slower read-write optical drives.

AER Energy's 12-volt battery accessory unit will run a typical notebook computer for 20 hours and can simultaneously power a cellular phone, using rechargeable zinc-air technology. Why they've shown it being used in a plane is a mystery, however — most airlines prevent you from using either a laptop or a cellular phone in flight.

Rosen said that producing a CD drive for the stacks would cost only a few dollars more than current CD drives.

Bill Lenth, the IBM researcher in whose name the patent for the technology has been filed, said he expects IBM to licence the technology for broad use in the computer and entertainment industries. The first CD stacks and drives could become available in about three years, he estimated.

Intel alliance for data over TV cable

Intel has announced it is teaming up with three major cable TV companies to develop technology that will allow PC users to send and receive data over cable TV cables. Because of the high throughput capacity of the coaxial cables used by cable companies, Intel said it will be possible for users to send and receive data at speeds up to 1000 times that possible in traditional modems which operates between 300 and 14,400 baud. Intel's partners in the venture are Telecommunications Inc (TCI), Rogers Cable Systems of Canada, and General Instruments.

Currently some 60% of American households are connected with TV cables. Increasingly, cable companies will be offering interactive TV services. Intel hopes it will be able to develop technology to also allow the cable to handle user-to-user data transmission. That way, individual users will be able to provide multimedia data services to anyone with a PC and a cable TV connection.

For cable companies the ability to offer such services would go a long way towards meeting government concerns about providing easy and cheap access to information superhighways, for a broad range of public and commercial interests.

IBM to make Mac clones?

The IBM-Macintosh? What would have seemed the most unlikely development in the personal computer industry just three years ago may well bring IBM-made Macintosh clones onto the market as early as this Christmas. Apple chief

Michael Spindler has indicated during a discussion with financial analysts that Apple is planning to allow one or more major computer maker to produce Macintosh clones. Most analysts concluded the likely partner Spindler was talking about was IBM.

"Apple is looking for a volume partner, not a strategic partner. They want a partner who can crank out the systems. It would highly surprise me if it didn't turn out to be IBM," said one of the analysts who attended the discussion with Spindler.

IBM would be a logical choice, considering the close operation between IBM and Apple on the Power PC processor development, the PINK object-oriented operating system under development by their Talligent joint venture, and the Kaleida joint venture which is developing multimedia products.

For IBM, a deal with Apple could help the company's struggling personal computer division maintain its leading market position in the PC field — a position that has come under severe pressure from Compaq, which has already surpassed IBM in the number of computers shipped. At the same time, Apple would benefit from a significant increase in overall market share for the Macintosh.

Spindler, who refused to reveal any details of where Apple stands with its licensing program, would only say that he expects the first companies to start making Macintosh clones within six months to a year.

Philips, Zenith in set-top box alliance

Philips Consumer Electronics, a subsidiary of the Dutch electronics giant, is teaming up with Compression Labs and Zenith Electronics to develop TV set-top decoder boxes that will be able to decompress both digital and analog video data sent over telephone and cable TV lines.

The boxes would allow both Cable TV operators and telecommunications companies to offer their customers video-on-demand, electronic shopping, over-the-phone video games, and other interactive services.

The boxes to be developed will be able to receive today's analog TV signals, as well as future MPEG-2 and Zenith's VSB-based digital transmissions within a single unit. Data compression technology will be provided by Compression Labs.

"Our extensive global engineering, marketing, and manufacturing infrastructure, combined with those of Zenith and Compression labs, make this group a powerhouse that understands what consumers and network providers need in this emerging business," said Bill Kennedy, senior vice president of Philips Digital Video Communications Systems.

PC pioneer goes out of business

Remember the 'Pet'? And who doesn't remember the 'Commodore 64' line of home and hobby computers. But after years of declining fortunes, Commodore International of West Chester in Pennsylvania is going out of business.

Commodore was among the earliest pioneers of the personal computer industry. Its '64' line dominated the home computer market in the early 1980's.

Like Apple Computer, Commodore lost its eminence in the industry after the introduction of the IBM PC. Unlike Apple, Commodore failed to cut out a solid niche market for its product lines.

In a final statement, the company said it will transfer all the remaining assets of the company to an unnamed company 'for the benefit of our creditors'. In addition, Commodore International said it put its largest subsidiary, Commodore Electronics, in liquidation.

Gates loses his cool on TV

Microsoft founder Bill Gates, in a rare display of public emotion and anger, walked out of an interview for the popular national weekly CBS television magazine 'Eye-to-Eye'.

The incident occurred when Eye-to-Eye host Conny Chung, who is also the co-anchor on the CBS Evening News, repeated a statement made by Stac Electronic's president Clow, the company that recently won a US$120 million patent infringement law suit against Microsoft. In the statement, Clow said: "A lot of people make the analogy that competing with Bill Gates is like playing hardball. I'd say it is more like a knife fight."

Gates turned visible angry as Chung read the statement. "Why be a mouthpiece for that silliness," the usually level headed Gates told Chung. He then took off his microphone, got up and said "Well, I'm done."

Gates refused repeated pleas from Chung to continue the interview. At one point Gates was shown stabbing his finger at Chung, while lecturing her about the ethics of her interview tactics.

Up until the incident, the interview had gone well. Chung has asked Gates questions about his recent marriage, and even got the multi-billionaire to perform his trademark stunt on national television; jumping over a chair from a standing start.

Asked about the notion that he may be a 'nerd' by some people's definition, Gates responded that he didn't mind that label one bit. "If nerd means that you can enjoy understanding the insides of a computer and sit in front of it for hours and play with it and enjoy it."

AT&T's US$4 billion Saudi telecom deal

Thanks to an intense marketing and lobbying campaign by both AT&T executives and top officials of the Clinton Administration, the American telecommunications giant was awarded the much sought after US$4 billion contract to modernise Saudi Arabia's telecommunications infrastructure. It is the largest foreign telecommunications contract ever received by an American company.

AT&T beat rivals Siemens of Germany, Alcatel Alsthom of France, and Northern Telecom of Canada. AT&T officials credited the Clinton Administration with helping swing the deal AT&T's way. Commerce Secretary Ron Brown actively lobbied for AT&T on two recent visits to Saudi Arabia, and Secretary of State Warren Christopher also spoke with high level Saudi officials about the deal.

Under the terms of the agreement AT&T will build a fibre-optics based network that will use all digital technology for advanced phone services to some 1.5 million Saudi users. That is twice the capacity of the country's current phone system. Also included is the construction of a digital wireless network capable of handling 200,000 subscribers.

20,000 more lay offs at Digital

As expected, Digital Equipment has announced a new major cost cutting program including the additional lay off of some 20,000 employees — nearly 25% of the company's remaining workforce. The action came just two weeks after the Massachusetts computer firm announced a disappointing US$183 million quarterly loss.

As tough as the action may be to swallow for DEC workers, DEC chief executive officer, Robert Palmer said that "Failure to act promptly will result in greater loss of employment." Palmer said DEC must achieve a ratio of revenue per employee (RPE) that is comparable to that of its biggest rivals, IBM and Hewlett-Packard. With 92,000 people on the payroll, DEC's RPE ratio is US$153,000. After cutting its workforce to about 65,000, the RPE will improve to about $200,000. IBM's current RPE stands at $250,000 and HP's at $235,000.

On Wall Street, Palmer's tough prescription for recovery was applauded and investors bought up DEC shares which rose 75¢ on the announcement to US$22.65. ❖

NEW PRODUCTS

Five watt CB

A palm size UHF CB with five watts of power has been announced by Philips, which introduced UHF CB back in the late 70's.

The new Philips P65 weighs only 300 grams, including battery, is 14cm long (plus antenna) and is 3cm thick. It has two selectable scanning modes, and 48 channels (40 simplex/8 repeater).

Features include a comprehensive LCD display with timed back lighting; high-low transmission power to conserve batteries; and user customised scan groups.

There are four battery size options — three of them rechargeables — and a large range of accessories. The standard version of the P65 is expected to sell for $600.

For further information circle 241 on the reader service coupon or contact Philips Mobile Communication Systems, Tally Ho Technology Park, 23 Lakeside Drive, East Burwood 3151; phone (03) 881 3666.

Electronic tagging system

Integrated Silicon Design has announced the introduction of its new Model 4000 system, aimed at mass market tagging applications.

The system suits applications where large numbers of tags are required, such as in parcel identification, document control, material tracking, manufacturing control and warehousing applications. Various models are available with read ranges from 150mm to 1m. Conveyor belt style readers can identify objects travelling at speeds up to 2m/sec.

The tags can be encapsulated to customer's specifications. Standard tags are proximity programmable and are a standard credit card size (72 x 40 x 4mm). Tag shape and size can be varied to customer requirements. High temperature tags (200°C) are also available.

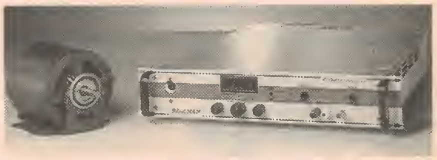
For further information circle 242 on the reader service coupon or contact Integrated Silicon Design, PO Box 99, Rundle Mall 5000; phone (08) 223 5802.

Motor tester has soft start

Behlman Electronics series of motor testers have a soft start capability, which can start motors even in locked rotor conditions. By folding back the voltage and slowly increasing it during acceleration 'Soft Start' eliminates the need for a high input current, and the need to restrain the motor during testing. This systen can start motors which normally require up to 140 amps of starting current.

The BL series delivers 1350VA of AC power, providing pure sinewaves, even during start up, with running currents of 14 amps at a 50% duty cycle. They provide fully adjustable frequency and voltage, low total harmonic distortion, 85% efficiency, 0.1% line regulation and 0.7% load regulation.

Behlman testers offer overload protection, true RMS digital readout of voltage and current, and remote DC programming for voltage and frequency. They require 9cm of rack height and weigh under 23kg.



For further information circle 243 on the reader service coupon or contact Nilsen Instruments, 150 Oxford Street, Collingwood 3066; phone (03) 419 9999.

Inmarsat-M satellite telephone

Alden Electronics has introduced the Alden Satphone Inmarsat-M satellite telephone. The Satphone is designed to provide mariners with convenient, affordable high quality digital telephone, fax and data connection services virtually anywhere in the world.

The Alden Satphone, model SP1600M (Marine) allows a vessel to make or receive a call over the public telephone network while at sea. The calls are placed by simply dialling the desired phone number. A fax machine or PC can be plugged into the Satphone to transmit and receive data at 2400 baud.

The antenna automatically tracks any of the four Inmarsat satellites covering the Atlantic, Pacific and Indian Ocean regions. A lightweight, briefcase model with a versatile AC/DC battery power supply is available for mobile land use.

For further information contact Alden Electronics, 40 Washington Street, Westborough, MA 01581-0500; phone (508) 366 8851 or fax (508) 898 2427.

Data capture recorder

Astro-Med have announced their Dash IV and Dash 8 chart recorders (4-channel and 8-channel).

Features include eight hour operation from internal rechargeable batteries, 300dpi amplitude resolution, data capture with 256Kb of RAM per channel, stackable data records and archival capability to floppy disk.

The recorder has a bright display for monitoring real time waveform activity, and differential inputs that accept AC or DC signals from 50mV up to 250V. Plug-in modules for thermocouple, high voltage, current, or DC bridge measurements are also available.

For further information circle 244 on the reader service coupon or contact Metromatics, PO Box 315, New Farm 4005; phone (07) 358 5155.

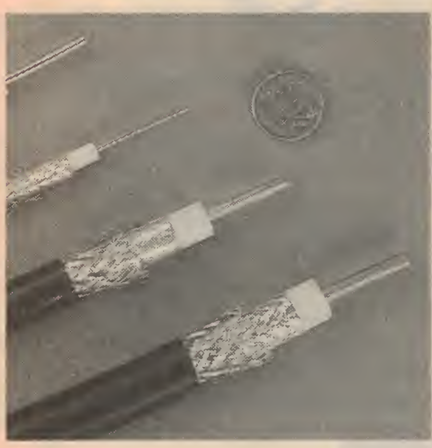
Double shielded, low loss coax

GFS Electronics have available the D-FB coaxial cable range, comprising the 5D-FB, 8D-FB, 10D-FB and 12D-FB, all with 50 ohms characteristic impedance. GFS say that apart from exhibiting low loss, this series of coaxial cables offer a number of advantages. For example 5D-FB has an outside diameter of 7.6mm, and a loss of 3.9dB/30m at 400MHz. Type 8D-FB has an outside diameter of 11mm, and a loss of about 2.5dB/30m.

The D-FB series features double shielding, consisting of an aluminium mylar foil which completely encases the cable's dielectric, surrounded by a high density tinned copper braid. The soft annealed solid copper inner conductor gives high flexibility and good bending properties.

Manufactured in Japan by Nippon Tsushin, the D-FB series suits a wide range of applications, including the mining, marine, industrial, commercial radio, broadcast and transport industries.

For further information circle 245 on the reader service coupon or contact GFS Electronics, PO Box 97, Mitcham 3132; phone (03) 873 3777.



New megger measures gigohms

The BM80 from AVO International is an insulation resistance and continuity tester, with five insulation test voltages and a measurement capability of up to 200 gigohms. The 250V, 500V and 100V insulation ranges can be used to test in full compliance with international specifications. The 50V and 100V ranges are to test sensitive equipment, such as printed circuit boards, computer peripherals and telecommunications equipment.

Features include a user selectable option of either a non-locking or a locking test button, a test lead resistance null facility, a separate voltage range with DC and AC (50 - 60Hz and 400Hz) measurement capabilities at 1% accuracy, and a 200mA continuity test current.

Standard features also include an analog digital display for fast, accurate readings, a continuity buzzer for fault finding, a voltage warning for user protection, a low current resistance range and long battery life.

For further information circle 246 on the reader service coupon or contact Nilsen Instruments, 150 Oxford Street, Collingwood 3066; phone (03) 419 9999.

DIN-rail DC/DC converters

Amalgen Control Systems has released a range of DIN-rail mounting DC/DC converters in both isolated and non-isolated configurations. The non-isolated model 6080 is a high quality 3A switching mode regulated type. Input voltage is from 56V DC to within a few volts of the nominated output voltage. Standard output voltages are 5V DC, 12V DC and 24V DC. Models 6081, 6082, 6083 and 6084 are the designated numbers for the isolated types.

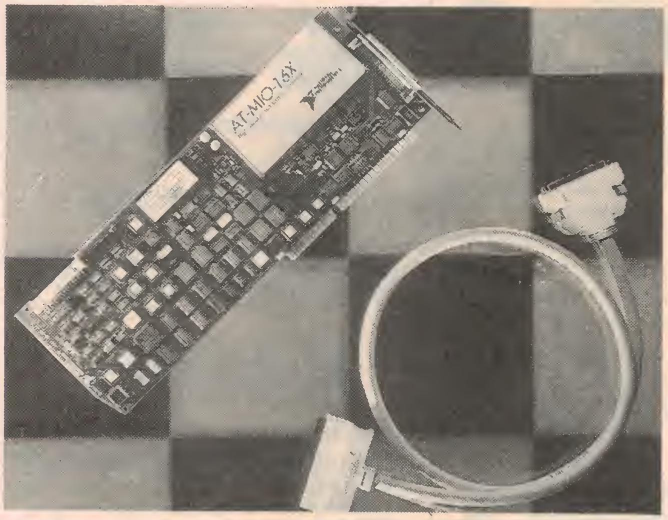
Various versions are available including single (up to 5W), dual (1.5W per chan-

nel) and bipolar (up to a total 5W for both channels). Input voltage ranges from 5V to 110V DC, and is protected by an internal fuse. Other ratings are also available. Isolation is better than 500V DC.

Both types are housed in a 22.5mm wide standard DIN-rail mounting case and a green LED on the front indicates when output power is available.

For further information circle 247 on the reader service coupon or contact Amalgen Control Systems, 43 Anderson Road, Mortdale 2223; phone (02) 570 2855 or fax (02) 580 5128.

Data acquisition board has 68-pin connector



National Instruments has announced a new 68-pin, shielded connector version of its AT-MIO-16X high performance analog, digital, and timing I/O board for PC AT computers. The company also announced the SCXI-1347 and SH6850 shielded cable assemblies.

The AT-MIO-16X has a 16-bit sampling ADC with 16 analog inputs configureable as single ended, pseudodifferential, or fully differential inputs. The card features sustained analog sampling rates up to 100kS/s. The board's two DACs re connected to two voltage output channels, there are eight lines of TTL compatible digital I/O and three 16-bit counter/timer channels. The 68-pin version has a trapezoidal metal connector that protects the pins and prevents the cable from being installed incorrectly.

The SCXI-1347 is a low noise shielded cable assembly — available in lengths of 1, 2, 5 and 10m — that connects the 68-pin AT-MIO-16X board to an SCXI chassis. The assembly includes a cable that is fully shielded against electrostatic discharge and external noise and a terminal block that converts one end of the 68-pin cable to a 50-pin connector. The cable also features quick-released locks so that the cable will not accidentally disconnect from the plug in board of SCXI chassis.

The SH6850 is a shielded cable assembly — available in lengths of 1, 2, 5 and 10m — that connects the 68-pin AT-MIO-16X with a wide variety of 50-pin low cost signal conditioning and termination accessories. It has a 68-pin trapezoidal locking connector on one end and a 50-pin ribbon cable assembly on the other. The cable is fully shielded against electrostatic discharge and external noise.

For further information circle 248 on the reader service coupon or contact National Instruments Australia, PO Box 382, North Ryde 2113; phone (02) 878 6758.

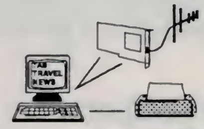
Handheld DMMs have 4.5 digits

A new range of high quality handheld meters has been released by Yokogawa Australia. The range includes current clamps with ranges from 200mA leakage current to 1000 amps and have functions including DC current, high speed auto ranging, data hold, frequency test, true RMS and analog signal output for recorders.

One impressive new current clamp has a 500Hz bandwidth, to connect to high speed recorders or oscilloscopes.

A selection of 23 DMMs are available, from low cost pocket meters to top of the range 50,000 count, 0.04% basic DC accuracy DMMs. In between there are all sorts of meters with special functions like RPM, temperature, dBm, auto reversing diode testing, back lit displays, adaptor inputs, display memory, frequency, max/min, true RMS, bar graphs and safety shutters to prevent you selecting volts when the probes are plugged into the current inputs, and many more features. All of these meters are built under an ISO 9001 quality management system.

For further information circle 165 on the reader service coupon or contact Yokogawa Australia, 25 Paul Street, North Ryde 2113; phone (02) 805 0699, or fax (02) 888 1844. ❖



The latest in microprocessors and peripheral products

Single board computer

Amtex Electronics has announced a new single board computer system for the embedded applications market. The board, manufactured by Innovative Technologies of the US, is designated the it/slc, and integrates all the functions normally found in a complete PC compatible system on a single six layer circuit board measuring 146 x 203mm, matching the footprint of a 5.25" disk drive.

The it/slc is available in 33MHz '386 and '486 versions and is completely compatible at hardware level with the IBM industry standard. Up to 16MB of SIM memory can be installed and an on-board VGA display controller supports analog, digital and flat panel monitors. A floppy disk controller and an IDE hard disk interface are also on-board.

Other standard features include two RS232 serial ports, a Centronics compatible port, real-time clock, keyboard controller and PS/2 compatible mouse port and math co-processor socket. The it/slc operates from a single +5V power supply, and with 2MB of memory typically consumes about four watts. An expansion bus header allows connection of virtually any off-the-shelf expansion card. For further information circle 204 on the reader service coupon or contact Amtex Electronics, PO Box 285, Chatswood 2057; phone (02) 805 0844.

DAQ boards have on-board DSP

Boston Technology has announced the Australian release of the DI 200 series, a range of data acquisition cards with Analog Devices ADSP-2101 DSP processors on-board.

The DI-200 features include 16 single-ended/eight differential 12-bit A/D channels, 83kHz acquisition speed; 16-bit counter/timer; 12-bit D/A channel; dual DMA; digital calibration; eight digital input and eight digital output lines, and 0 - 10V or +/-10V input range.

Other features include all acquisition parameters individually programmable for each channel; analog triggering based on channel, slope, and level; pre-trigger and post-trigger capability; signal averaging of consecutive readings up to 32K per channel; and 256 element input scan list for sampling channels in any order. Where expansion slots are unavailable, the parallel port version of the DI-200 may be used. This comes with NiCad batteries, which provide about 12 hours of continuous use, and a recharger to suit.

The DI 300, with the same analog front end as the DI 200, has three pipe lined ADSP-2101 DSP chips. One is reserved for A/D processing, while the other two provide 12.5 MIPS each of processing for real-time tasks.

Each member of the DI 200 family is supplied with a software development kit. This is an extensive collection of software routines suitable for most languages. DOS programmers can use the linkable object module with QuickBASIC, Quick C, C, or assembly language. Windows programmers can use the provided DLL. Included routines allow for control of all the features of these boards. A software development kit is available as an option for the DI 230 board.

Portable data acquisition system

National Instruments has announced the battery powered version of its SCXI signal conditioning and data acquisition system. Called the SCXI-1000DC chassis, the system is equipped with plug-in modules for portable or remote applications. A battery pack-charger and power supply are available as separate accessories.

The SCXI-1000DC is a DC-powered four slot SCXI chassis with built-in screw terminals to receive power from any 9V to 15V DC battery or power supply. It can house up to four SCXI modules to condition and acquire up to 128 signals. The SCXI-1382 is a 12V DC battery pack that attaches directly to the chassis, and is able to power the chassis for over four hours. It includes a two stage battery charger.

For further information circle 201 on the reader service coupon or contact National Instruments Australia, PO Box 466, Ringwood 3134; phone (03) 879 9422.

For further information circle 205 on the reader service coupon or contact Boston Technology, PO Box 1750, North Sydney 2059; phone (02) 955 4765.

Reconfigurable hardware card

Altera has announced its reconfigurable interconnect peripheral processor card, the RIPP 10. The card was originally developed by Altera for universities and R&D centres investigating the capabilities of reconfigurable hardware in improving processing performance. Its commercial release is in response to a demand from mainstream designers.

The card is a PC compatible, ISA bus board that supports up to 100,000 gates of reconfigurable logic. The RIPP 10 design allows devices with FPIDs (field programmable interconnect device), trading programmable logic capacity for programmable interconnect capability, thus optimising the board for end user applications. In its maximum configuration, the board would use eight 12,000 gate FLEX EPF8188s and a 4000 gate FLEX EPF8452, giving it a total capacity of 100,000 usable gates of reconfigurable logic.

The board can be configured, for example, as a neural network or as a special purpose signal processor. These applications are usually implemented by programming the necessary algorithms into either a general purpose microprocessor, or a digital signal processor using the native language of the processor. RIPP 10 has a performance advantage because it can be programmed to execute the algorithms directly in hardware.

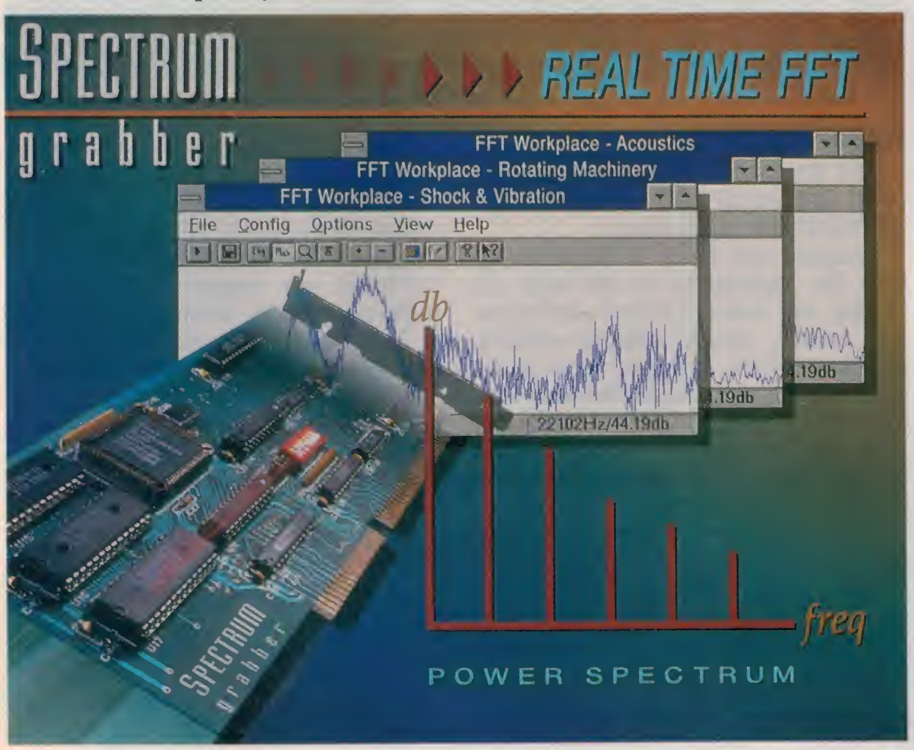
For further information circle 210 on the reader service coupon or contact Vel-

Spectrum grabber does real-time FFT

Dataq Instruments has introduced its DI-2380 Spectrum Grabber card for applications needing real-time frequency analysis. The card supports virtually any A/D or D/A card from any manufacturer through use of its 'DMA listener' operation. The card can be programmed to eavesdrop of any 8-bit or 16-bit DMA channel being used by an A/D card that is inputting data, or a D/A card that is outputting data. It then generates a continuous 1024-point FFT from the DMA data, completely in the background, and makes this information available to any program.

The card suits many applications in general spectrum analysis, vibration, and acoustics. It can be used in dynamic signal analysis for the isolation of mechanical noise, and the characterisation of vibration signal sources or PC-based sound systems. A real-time spectrum signature profile is possible for signal types ranging from electrophysiology to electrical/electronic classifications.

For further information circle 203 on the reader service coupon or contact Sci-Tech, 155 Plenty Road, Preston South 3072; phone (03) 480 4999.



tek, 18 Harker Street, Burwood 3125; phone (03) 808 7511.

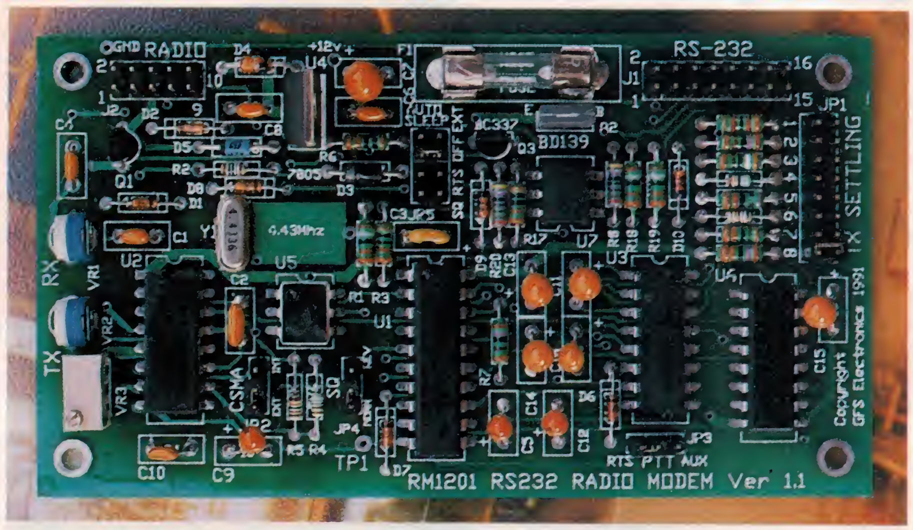
IEEE 488.2 controller board

National Instruments has released a new version of its high performance IEEE 488.2 controller board for PC AT computers with 16-bit plug-in slots. The AT-GPIB/TNT now features the company's new TNT4882C application-specific integrated circuit (ASIC). The board performs the basic talker, listener, and controller functions required by the most recent GPIB standard (IEEE 488.2) and implements the HS488 mode of operation for GPIB, resulting in data transfer rates up to 4MB/s on the EISA bus for both read and write operations.

Users can program the card with the company's NI-488.2 for DOS and Windows software, the Windows version of its LabVIEW graphical programming system, and its LabWindows automatic code generating software for DOS. A PC AT equipped with the card becomes a high performance IEEE 488.2 controller able to monitor, control, and communicate with thousands of GPIB-based engineering, scientific, or medical instruments and graphics equipment.

The card is shipped with the company's NI-488.2 driver software for MS-DOS and Windows, which is a software package that simplifies programming IEEE 488.2 interfaces. It is installed as a loadable device driver and includes over 50 GPIB-related routines and functions.

For further information circle 206 on the reader service coupon or contact National Instruments Australia, PO Box 466, Ringwood 3134; phone (03) 879 9422.



Radio modems

GFS Electronics has released two low cost, industrial radio modems for VHF/UHF radio applications.

Designed and made in Australia by GFS for applications in the areas of mining and industrial data acquisition and control, remote sensing, satellite realtime DGPS systems, as well as telemetry, the two radio modems are also claimed as being suited to interfacing with a wide range of PLCs (programmable logic controllers) and intelligent data acquisition equipment.

Both models in the series, RM-1201 and RM-1202, provide a 1200 baud, 8-bit transparent asynchronous interface between either an RS-232 (RM-1201) or RS-422 (RM-1202) port and a simplex or full duplex VHF/UHF radio system.

They provide DTE handshaking and radio PTT (push-to-talk) control via their RTS and CTS data lines. If required, error correction can be implemented by using an external protocol, such as one of those commonly available in PLCs.

Both the RM-1201 and RM-1202 radio modems are supplied as small, lightweight, easily mountable, unhoused PCBs, 115mm wide x 63mm high. They can operate over a temperature range of -40°C to +85°C. Both cards can be powered from a 12V DC supply, taking 60mA when operating. The RM-1202 can also operate from a 5V supply. PCB mounted IDC connectors are used for both the radio and data ports. Power to the modems can be supplied either via the radio connector or separate power pads on the PCB.

For further information circle 202 on the reader service coupon or contact GFS Electronics, PO Box 97, Mitcham 3132; phone (03) 873 3777. ❖

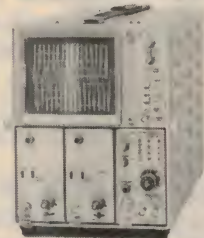
High Purchase Costs Taking a "Bite" Out of Your Budget?

NOT AT MACSERVICE. WE HELP YOU STRIKE BACK BY OFFERING THE LOWEST PRICES AND GOOD OLD FASHIONED SERVICE - Just look at these SPECIALS

HEWLETT PACKARD
410C Multimeter
- 100Hz to 700MHz
- AC/DC Volts
- DC Amps
- 10 ohms to 10M ohms
- Complete with probes

BARGAIN $265

TEKTRONIX
7603 Oscilloscope
- Mil spec AN/USM 281-C
- Triggers to 100 MHz
- Dual Trace
- Dual Timebase
- Large Screen

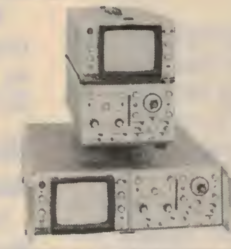


SUPER DEAL $950

HEWLETT PACKARD
355D Step Attenuator
- BRAND NEW
- 0 to 120dB
- 10dB steps
- DC to 1000MHz

UNBELIEVABLE $295

HEWLETT PACKARD
180 Oscilloscope
- DC to 50MHz or 100MHz
- Dual Trace
- Dual Timebase
- Large Screen



SUPER SALE $775 (50MHz); $925 (100MHz)

BALL EFRATOM M100
Rubidium Frequency
- Calibration certificates
- Perfect for ISO accreditation
- GPS applications
- Ruggedised military design

GREAT VALUE $2950 (new)

Video Dist Amp & Cable Equaliser			$100
ADVANCE	H1B	Audio Generator	$150
ADVANCE	PP7	30V3A DC Power Supply	$150
BPL	CB154/4	Electrolytic Cap Bridge	$600
B&K	1466A	10MHz Oscilloscope	$275
DANA	7-1/2	DMM & Freq.	$175
EH	129	Pulse Generator	$90
ELGENCO	603A	White Noise Gen 5MHz	$200
ENI	503L	RF Power Amp 40dB 510MHz	$1025
FLUKE	102	VAW Cal Meter	$125
FLUKE	9010A	Logic System Troubleshooter	$1000
GR	1191-B	Counter DC-35MHz	$150
GR	1608	LCR Meter	$1500
HP	211B	Square Wave Generator-	$275
HP	302A	Audio Selective Level Meter	$145
HP	400L	True RMS Voltmeter	$170
HP	410B	Vacuum Tube Voltmeter	$130
HP	432A	Power Meter (c/w cable & sensor)	$875
HP	467A	Power Amp	$175
HP	536A	Frequency Meter	$150
HP	721A	30V 0.3A Power Supply	$60
HP	1610B	Logic Analyser	$350
HP	1980	100MHz Storage Oscilloscope	$1650
HP	3400A	True rms voltmeter	$425
HP	6226A	Power Supply 40V 1.5A	$200
I/S Elect.	845	Prog Function Generator	$800
MARCONI	TF893A	Power Meter	$150
MARCONI	TF1020A	RF Power Meter 75Ω 100W	$75
MARCONI	TF1020A-1	RF Power Meter 50Ω 100W	$150
MARCONI	TF1245/46/47	Q Meter 40KHz-300MHz	$600
MARCONI	TF2167	RF Amplifier 47dB gain	$600
MARCONI	TF2300	FM/AM Mod Meter	$500
MARCONI	TF2300A	FM/AM Mod Meter	$700
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MARCONI	TF2914	Insertion Signal Analyser	$150
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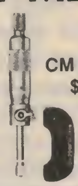
SHALLTRONIX	10K	Decade Box	$150
SIEMENS	G2212	1.6/18.6MHz Generator	$250
SIEMENS	P2005	Controllable Phase Meter	$200
SOLA	Series 200	750VA Line Stabiliser	$180
Spectral Dyn.	SD112-1	Voltmeter Freq-Log Conv 2ch	$150
Systron Don.	1037	500MHz Counter	$350
Telequipment	CT71	Curve Tracer	$900
TRIMAX	G1B	Ionisation Tester 10kV	$260
TRIO	SG402	RF Signal Gen 30MHz	$75
VARIAC		0/280V @ 15A	$260

NEW METROLOGY INSTRUMENTS AT FANTASTIC PRICES!!!

VCE 150 $120



CM 25 $45

M36 $55

VCE-150	150mm/6" Electronic Digital Vernier in box	$120
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VCD-6	6" x 0.001" Dial Vernier Caliper	$75
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VC-150	Dual Scale Vernier Caliper 150 x 0.02mm/6" x 0.001"	$35
VC-200*	Dual Scale Vernier Caloper 200 x 0.02mm/8" x 0.001"	$45
VC-300*	Dual Scale Vernier Caliper 300 x 0.02mm/12" x 0. 001"	$75
VC-600*	Dual Scale Vernier Caliper 600 x 0.02mm/24" x 0.001"	$250

*WITH FINE ADJUSTMENT

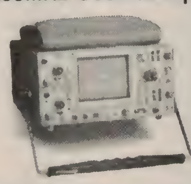
JUNE SUPER SPECIALS

TEKTRONIX 465M
100MHz Oscilloscope

Bandwidth DC to 100MHz; Rise time <=3.5ns; Deflection factor 5mV/div to 5V/div in 10 steps; DC accuracy ±2%; 2-channel display mode; Horizontal deflection - main & delayed timebases; A - 0.5s/div to 0.05µs/div in 22 steps; B - 50ms/div to 0.05µs/div in 19 steps; Trigger - main/delay sweep; Coupling AC, DC, LF Rejection, HF Rejection

NEVER BEFORE DISCOUNTED TO $1150

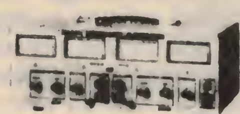
TEKTRONIX 475
200MHz Oscilloscope



Bandwidth DC to 200 MHz; Rise time <-1.8ns; Deflection factor 2mV/div to 5V/div; 2-channel display mode; Trigger view; Horizontal deflection - main & delayed timebases; A+B 0.01µs/div to 0.5s/div; x10 mag extends max sweep rate to 1ns/div

ONE TIME ONLY DISCOUNTED TO $1850

LODESTAR
Affordable Laboratory Instruments



PS303D Dual Output Supply
- 0 to 30V and 0 to 3 amps
- Four output meters
- Independent or Tracking modes
- Low ripple output

$385 + Tax

PS305D Dual Output Supply
- 0 to 30V and 0 to 5 amps

$430 + Tax

PS303 Single Output Supply
- 0 to 30V and 0 to 3 amps
- Two output meters
- Constant current/voltage
- Low ripple output

$225 + Tax

PS305 Single Output Supply
- 0 to 30V and 0 to 5 amps

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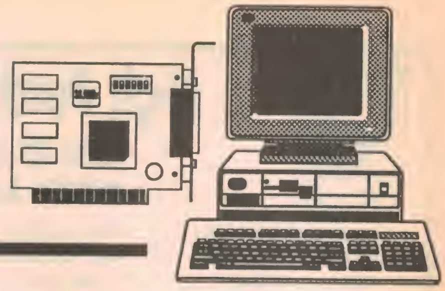
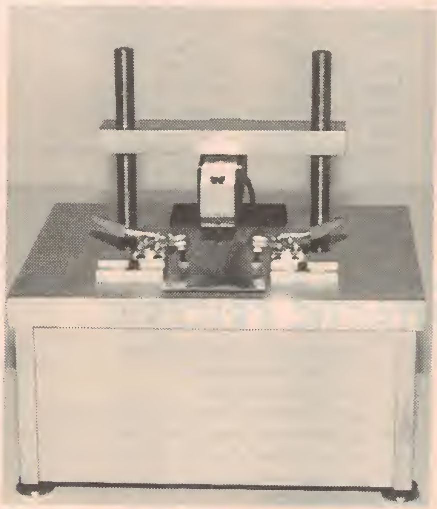
Computer News and New Products



Computer-based test machine

The Pro-tester from Qualitest is a computer-based test machine that adapts to various needs by changing the probe and software. It can be used to assist in incoming quality control, process control and process optimisation.

The Windows-based software includes a statistical process control module and further modules are being added. The tester assists in quantifying and analysing adhesion, tackiness, cleanliness, low force fatigue and other factors related to low forces. For instance, it can be used to test the stickiness of solder paste used in surface mount soldering.



For further information contact Qualitest, 15 Forest Ridge Drive, Toronto, Canada M6B 1H2; phone (416) 785 9357, or fax (416) 789 1498.

Windows data acquisition software

DasyLab for Windows is software for data acquisition, simulation, analysis and control that runs under the Windows environment. The program, designed for scientists and engineers, enables data to be acquired, viewed, analysed and sent out. An application is set up by creating a flow chart that connects the module icons.

Currently available modules include: ADC and DAC, triggers, digital I/Os, mathematics, statistics, digital filters, spectral/FFT analysis, function generators, multiple displays for graphic display of results, logical operations, event counters, timers, classification, digital voltmeters, indicators, switches and I/O files.

Flow charts can also be tested without having to acquire data. To do this, the ADC icon is replaced by the signal generator icon. Complex waveforms can be created by combining the signal generator and mathematical icons. PID control, binary logic and control can be realised using the corresponding I/O function icons. Special pulse generators can be used for exact time-dependent control, even with complex control signals.

For further information, circle 161 on the reader service coupon, or contact Sci-Tech, 155 Plenty Road, Preston South 3072; phone (03) 480 4999.

RGB to PAL

The RGB Videolink Scan Converters from Trace Pacific transform computer graphics to television format (PAL and NTSC) in real time. This allows computer graphics to be recorded on any VCR, or displayed on a video projector, teleconferencing system or composite monitor.

The Converters synchronise to any computer RGB signal with a horizontal scan rate from 15kHz to 90kHz, at resolutions up to 1600 x 1200 pixels (interlaced). Inputs are accepted from PCs, Macintosh IIs and various workstations (Sun, DEC, IBM, Silicon Graphics etc).

The RGB inputs are digitised, filtered and buffered in a frame store. The digitised image is then converted to analog RGB signals at video resolution and encoded into PAL CCIR or NTSC RS-170A composite video. S-video, as well as RGB outputs at 31.5kHz for projectors are also provided.

For further information, circle 162 on

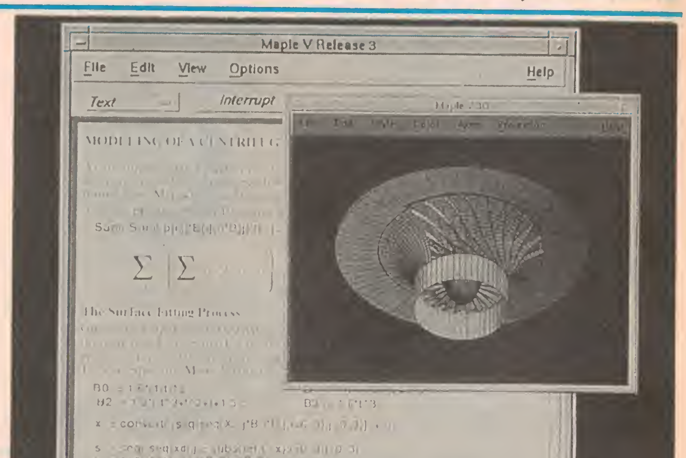
Maple V has a new release

Hearne Scientific Software has announced Maple V, Release 3, a new version of this mathematical software package. The new version extends the symbolic and numeric computational power, graphics capabilities and programming features of the previous version. New features include an easy-to-use worksheet interface, including export to LaTeX, mathematical robustness, interactive graphics and a help facility with keyword searches within help pages.

Significant work has also been done to extend Maple's power in the areas of integration, exact solutions of equations, and manipulation of symbolic expressions. The solution of differential equations has been improved and includes two new algorithms for solving linear differential equations as well as facilities for manipulation and working with incomplete solutions.

The Macintosh and Motif versions of Release 3 add improvement to the Help facilities, including keyword search capabilities. Upgrade pricing to Windows Release 3 is $250, and the recommended retail price is $950.

For further information, circle 166 on the reader service



coupon, or contact Hearne Scientific Software, Level 6, 552 Lonsdale Street, Melbourne 3000; phone (03) 602 5088.

the reader service coupon, or contact Trace Pacific, 4/265 Williamstown Road, Port Melbourne 3207; phone (03) 646 5883.

New PowerBook from Apple

Apple Computer Australia has announced five new PowerBook systems that are based on Motorola's 68LC040 microprocessor. The new PowerBooks are upgradeable to PowerPC microprocessor technology in the future. PowerPC, a joint development between Apple, IBM and Motorola, represents the platform for the next generation of personal computing.

The latest portable range from Apple includes three models of the all new PowerBook 500 series and two new enhanced versions of the PowerBook 200 series. The series includes the 520, 520c and 540c models (the 'c' signifies colour screen).

The 520 models have either greyscale or dual-scan colour passive-matrix displays and a 68LC040 chip running at 50/25MHz (processor/bus speed). The 540c has an active matrix colour display (its chip runs at 66/33MHz). They all have 240mm diagonal screen and offer up to 36MB of RAM expansion. Hard disk sizes are 150MB for the 520 and 520c models and 320MB for the 540c.

The 280 and 280c share many of the 500 series features including the Motorola 66/33MHz 68LC040 processor and upgradeability to PowerPC. The Duo 280 has a 240mm active matrix greyscale screen and the 280c has a 213mm active matrix colour display. Both offer up to 40MB of RAM expansion, and with Type III batteries provide up to seven hours performance. Hard disk drives are 200MB for the 280 model and 320MB for the 280c.

Recommended retail pricing (including tax) for the new PowerBook models is: 520 \$4495; 520c \$5495; 540c \$7495; 280 \$5495; 280c \$6495.

For further details circle 163 on the reader service coupon or contact your Apple dealer.

25mm 'virtual reality' VDU

Tektronix has introduced a 25mm colour display system for the virtual reality market. This pre-production colour display system, called the EX100HD, is the latest in a series of products that use Tektronix' pi-cell technology and colour shutters. This display unit is aimed at organisations prototyping or designing virtual reality and helmet mounted display products, which typically require a high resolution, two headed 25mm colour display system.

The EX100HD consists of two multiscan colour display heads, a power module and a 110/220V AC autoswitching power supply. The heads, which weigh about 150 grams are connected to the power module by 1.5m cables. The goal was to keep most of the electronics and weight in the power module rather than in the display heads. The image size is 20.3 by 15.2mm with a spot size of less than 0.04mm. The result is a clear, sharply defined image with an unlimited number of colours, depending on the capability of the controller.

The VDU can be run on the Silicon Graphics RealityEngine 2, which can support field-sequential RGB monitors. A PC controller board (EX100G) to run the display system on a PC is also available.

One of the main difficulties in getting the full benefit of virtual reality (Vr) has been the lack of high quality, full colour displays. Tektronix claim the EX100HD will solve this problem and users will be able to obtain the full potential from their Vr systems.

For further information circle 167 on the reader service coupon or contact The Dindima Group, PO Box 106, Vermont 3133; phone (03) 873 4455.

Interactive SPICE

The new ICAP/4 Virtual Circuit Design Lab is a circuit simulation system that gives the designer a completely interactive environment. ICAP/4 integrates

schematic entry, the new interactive IsSpice4 simulator, model libraries, and graphical waveform analysis. The Windows version uses all 32-bit code and extended memory, allowing it to run in Windows 3.1x, Windows NT, and the upcoming Windows 4.0.

The ICAP4 environment is different from other SPICE based simulators in that once the IsSpice4 simulator is started, the user is free to interactively explore the design by running different analysis, changing circuit values, and measuring performance. This is accomplished without having to close and restart the simulator and without having to alter the SPICE input netlist. All circuit waveforms are displayed in real time as the simulation runs.

The simulator employs two tools to enhance simulation throughput. The first is a real time Cross Probing tool that allows circuit waveforms to pop-up directly on the schematic. The other is an Interactive Stimulus mode. In this mode, the user can interactively sweep any number of component or model parameter values and compare the changing circuit performance. This results in a simulation that is very fast because the program and the netlist do not have to be reloaded before each change is made.

For further information circle 165 on the reader service coupon or contact ME Technologies, PO Box 50, Dyers Crossing 2429; phone (065) 50 2200, fax (065) 50 2341.

Low cost handheld colour scanner

Genius Australia has released a low cost handheld colour scanner which enables Windows users to deliver true 24-bit colour to desktop publications and presentations. The Genius C105 PRO handheld scanner, which is bundled with both optical character recognition (OCR) and image processing software, detects up to 16.7 million shades of colour and can work equally as well in both 256 greyscale and black and white modes. Resolution can be software adjusted between 50 and 400dpi and the system can scan to a width of 105mm.

The C105 features a slide to guide the scanner in a straight line, ensuring images are not scanned on an angle. Even if this happens, the software can rotate by up to six degrees, to merge images correctly.

The iPhoto Deluxe software included with the scanner enables the user to scan, edit, process and create special effects with images and photographs. Its JPEG compression function allows the user to reduce image file size by up to 100 times.

The Genius C105 PROscanner retails for $718 but is available at the introductory price of $675 for a limited time.

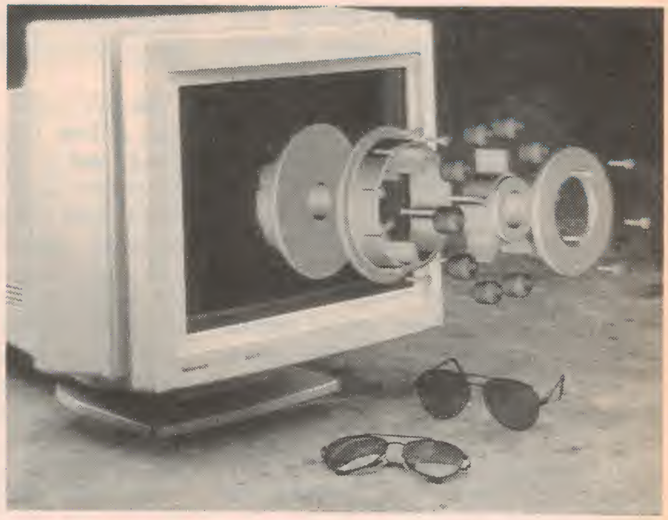
For further information circle 170 on the reader service coupon or contact Genius Australia, 4 Briar Street, Fulham Gardens 5025, phone (08) 235 3488.

19" colour stereoscopic VDU

Tektronix has announced its new 19" colour, stereoscopic displays. These displays have an integrated liquid crystal modulator and are used with passive stereo glasses. The displays, designed the SGS19U and the SGS19C, are additions to a new series of stereo displays that incorporate Tektronix's patented pi-cell technology.

The stereoscopic displays consist of an easily detachable, liquid crystal modulator with a 19" viewing area, a high resolution colour monitor and four pairs of passive glasses. The SGS19U can be driven in stereo mode either with normal vertical sync or with an external frame sync. The SGS19C display can be used with any stereo-ready workstation or computer that provides a 50 - 152MHz frame sync signal to drive the stereoscopic modulator. Both displays can also be used with a scan converter and cameras to create real time, stereoscopic video.

The large area screen-sized liquid crystal modulator consists of a pi-cell, a linear polariser and a quarter wave retarder and provides different polarisation for the left and right eye images. The special, lightweight polarising spectacles worn by the user will then decide the circularly polarised images to provide the left and right eye views.



For further information circle 164 on the reader service coupon or contact The Dindima Group, PO Box 106, Vermont 3133; phone (03) 873 4455. ❖

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NEW CHIPS IN STOCK

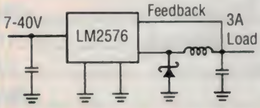
LM1203 RGB Video Amplifier System

The LM1203 is a wideband video amplifier used in many high resolution colour monitors. In adddition to three matched video amplifiers (70MHz @ -3dB) it also contains three gated differential input black level clamp comparators for brightness control and three matched attenuator circuits (±0.1dB) for contrast control. There's provision for independent gain control of each video amplifier as well as a video input voltage reference.

We have been getting request for this part from service technicians. At **$4.25** it could give your monitor a new lease of life!

LM2576 Simple Switcher Regulator

This little beauty provides all the active functions for a step-down (buck) switching regulator capable of driving a 3A load with excellent line and load regulation. Output voltage range can be set between 1.23V and 37V with a guaranteed 3Amp output current. Only 4 external components needed! Internal oscillator has a fixed 52kHz frequency. TTL shut-down capability plus thermal and current-limit protection. Dramatically reduces the need for heat sinking **$9.95**



TEA2000 PAL/ NTSC Colour Encoder

Encodes colour information and provides composite video output for driving a video modulator. PAL/NTSC selectable. Generates burst timing and PAL-switch functions. 6 bit binary TTL compatible input generates 64 different colours. Used in Silicon Chip Pattern Generator (Nov 91) **$14.20**

Data Switches

S25-AB
DB25 socket terminations. Allows 1 computer to select between 2 printers or 2 computers to share 1 printer.
All pins wired **$29.95**

S9-AB
DB9 terminations. As S25-AB **$29.95**

36pin Centronics terminations. As S25-AB **$49.95**

S25-ABCD
DB25 socket terminations. Allows 1 computer to select between 4 printers or 4 computers to share 1 printer. **$49.95**

S36-ABCD
36 pin Centronics version of S25-ABCD **$54.95**

S25-X
DB25 terminations. 2 in 2 out crossover **$55.00**

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CL-D09M/D09M-2M	9 to 9 M/M 2 Metres,	$9.95
CL-D09F/HDD0915M	2M 9 Skt to 15 Plug,	$11.95
CL-D0915F/D0915M	2 Metre High Density,	$12.95
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CL-D15F/D15M-2M	15 female to 15 male	$8.95
CL-D25F/D25M-2M	D25 Plug to Skt 2 Metre	$13.95
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CL-PRNTR-ST-10M	10 Metre Printer Cable	$25.95
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Aussie made JED PC EPROM Programmer Now in Stock

Australian designed and made and programs most popular EPROM's and FLASH proms. Just connect to the parallel/printer (Centronics) port of any IBM compatible computer using a DB25 connector and you can program 28 and 32 pin devices ranging from 2764 to 27080 and their derivatives. Ideal for use with lap-tops – no plug-in cards or complications. Programmer is completely hand-free. All controls are via the attached computer. Support software gives feedback of progress. Functions available include Blank check, verify EPROM to disk file, Auto ID, Read and Write EPROM to disk. EPROM contents can be viewed and single hex bytes altered. Operation can be either manual or automatic using the built-in ID mode of the EPROM to match the most efficient programming algorithm to the device. Requires only minimal memory as programming is done in "chunks".

Support the local product! Excellent value at **$363.00 inc tax**

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Now there's no excuse for overheating equipment. We have a limited quantity of high quality JAPANESE fans made by Matsushita Electric. The brand name is Panaflo and they are ultra-quiet, brushless, ball bearing types, model number FBP-08B12L. They run off 12Vdc, draw only 120mA and measure 80mm square by 32mm deep. You could pay around $25.00 for a fan made in Taiwan.

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9 to 15HDD	
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HDD15 Plug to Plug	$7.95
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Interface Converters

How do you get your RS-232C equipment to communicate with other devices using the RS-422A interface?
Easy with our

RS-232C/RS-422A converter
RS422A uses balanced differential signals which allow communication over much greater distances – up to 1.2km (4000 feet) – at bit rates as high as 90k/sec. For multi-drop systems one driver will feed up to 10 receivers.
Uses Male DB25 connector for the RS-232C interface and a female DB25 for the RS422A. No handshake is required. Power from a plug-pack is only 200mA at 9Vdc. **$97.95**
(optional plug pack $22.95)

RS-232C/RS-485 converter
RS-485 is the enhanced version of RS-422A. It allows multiple drivers and receivers on a 2-wire system. Converter is similar to above. Will handle up to 32 drivers and receivers on any one 2-wire system! Each converter has one RS-485 driver and receiver. Power is by 9V plug-pack **$111.90**
(optional plug pack $22.95)

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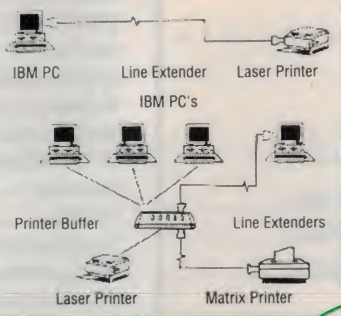

Hakko 926 Soldering Station

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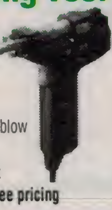

- Now with 100W ceramic heater
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KEY TO CODING:
A Kits and modules
B Tools
C PC boards and supplies
D Components
E IC chips and semiconductors
F Test and measuring instruments
G Reference books

Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

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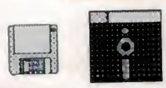

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